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ABSTRACT

Basic information about heart disease and functional capacity assessment and its application to activity/job counseling are presented in this handbook for vocational rehabilitation counselors. Sections include the following: impact of heart disease; basic anatomy and physiology (e.g., the heart, pulmonary circulation, causes of cardiac pain, and cause of rhythm abnormalities); types of heart disease (e.g., congenital, acquired, rheumatic, pericardial, pulmonary, and primary myocardial); causes of disability in cardiac disease (e.g., heart failure, arrhythmias, and psychosocial adaptations); evaluation of disability (e.g., basic required data, additional procedures including stress evaluation, Holter monitor, cardiac catheterization, and vocational evaluation); and rehabilitation in cardiac disease (principles of cardiac rehabilitation; in-hospital rehabilitation; post-hospital rehabilitation; and medical, surgical, psychosocial, and vocational management). Concluding the handbook is a list of selected readings and a glossary of terms. (JH)

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CARDIAC REHABILITATION

A HANDBOOK FOR VOCATIONAL REHABILITATION COUNSELORS

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INTRODUCTION

Cardiovascular diseases affect more individuals in the United States than any other group of illnesses. At the time of this writing, only a small percentage of these potential clients are being served by vocational rehabilitation counselors. There are probably several reasons for this: the client's return to previous employment, retirement, lack of knowledge regarding availability of Vocational Rehabilitation services, failure of the physician to utilize Vocational Rehabilitation services (probably the major cause), failure of the counselor to ensure that referral sources are familiar with Vocational Rehabilitation service capabilities and reluctance of the counselor or Vocational Rehabilitation system to encourage or accept cardiac clients. Some have suggested that this reluctance may stem from a lack of confidence felt by many counselors in dealing with cardiac clients.

Because of the authors' strong belief in comprehensive cardiac rehabilitation, this handbook is written to assist, stimulate, and encourage the vocational rehabilitation counselor to become an active participant in the cardiac rehabilitation process. The information presented should help fill knowledge and philosophy gaps and should therefore contribute to developing a sense of confidence and greater responsibility on the part of the vocational rehabilitation counselor in dealing with cardiac clients.

The authors of this handbook believe that the vocational rehabilitation counselor is a key person in the cardiac rehabilitation team. Not only does the counselor provide vocational counseling services, but should become the liaison between client, physician and employer. In order to fulfill these tasks, the counselor must have a comprehensive

knowledge of heart disease and how it affects the physical, social, emotional, and vocational aspects of the client's life. The handbook is designed to promote an appropriate level of understanding in these pertinent areas. This volume is not exhaustive in its detail — information is given to provide the counselor with enough knowledge and insight to be able to deal with the client adeptly, with compassion and understanding and without fear.

The vocational rehabilitation counselor should serve as a liaison between the client and other rehabilitation professionals, should be able to recognize and manage, or provide access to persons capable of managing all sources of disability in cardiac disease and, above all, should function as an advocate for the client in all associations that may affect the client's re-entry in and adjustment to the world of work: employer, colleague, community and family. The handbook will provide information necessary to the counselor to function as a client advocate; the counselor must generate the internal motivation, desire and dedication required to become an effective advocate.

The handbook is designed to give the counselor an understanding of disability in heart disease, and an appreciation of the natural history of heart diseases so that vocational goals can be logically set. In addition, some detail will be given regarding the functional capacity assessment and its application to activity/job counseling. Some of the material presented may seem to be unnecessary at first reading. It is included because the authors feel it is necessary if the counselor is to develop a "feel" for the client with heart disease.

An effort has been made to write this handbook in a style that is easily understood and to organize the material so that it can be located and referred to quickly and easily. This is not to suggest that the handbook is designed to be used primarily as a reference volume. On the contrary, it should be most valuable when read in its entirety and should appeal especially to the counselor with a special interest in the cardiac client. There are sources of additional information listed in the Selected Additional Readings which should be consulted for information and detail.

The client with heart disease has hidden disabilities — these can be just as restrictive as many obvious handicaps and, in addition, the underlying illness is often life-threatening. The client's response to the illness and the associated disability may be quite varied. Consequently, there is no "cookbook" approach to the management of

these clients. General guidelines can be given, but the counselor must be perceptive and creative in applying these guidelines to the individual client. When this is accomplished, dealing with the cardiac client becomes a stimulating, challenging, often complex and usually rewarding experience.

IMPACT OF HEART DISEASE

Although cardiac clients comprise a small portion of the average counselor's case load, these clients come from one of the largest groups of severely disabled in the United States.

Cardiovascular diseases comprise the major group of medical problems in the United States. The economic impact is enormous. The 1979 estimated cost of cardiovascular disease in the United States was 35.1 billion dollars comprised of (in descending dollar amounts) hospital and nursing home services, loss of output due to disability, physician and nursing services and cost of medications.

Atherosclerotic coronary heart disease (ACHD) is the most important cardiovascular disease in terms of numbers afflicted and the dollar cost. Atherosclerotic coronary heart disease has its major effect on the coronary arteries producing sudden death, heart attack, angina pectoris (chest pain due to inadequate oxygenation of a portion of the heart muscle), congestive heart failure and arrhythmias (irregularities of the heart rhythm). This disease is the single most important medical problem in the United States and affects at least 4,000,000 citizens, causing approximately 1,000,000 heart attacks each year from which there are about 350,000 survivors. One-third of those who have heart attacks are less than 65 years old. Barring significant physical or psychosocial disability, these younger survivors of heart attack should be candidates for a return to gainful employment. Of these, perhaps 25 percent (or more) would profit from a vocational rehabilitation (VR) counselor's services — a total potential pool of approximately sixty thousand clients. With national VR rolls containing fewer than 5 percent of clients with cardiovascular disease (less than ten thousand), the unmet need is obvious and immense. These figures do not include clients with other cardiovascular diseases — an additional three-hundred thousand men and women, seventy-five thousand under age sixty-five.

The reasons for these few referrals are not always clear. Some possibilities include: failure of physicians to refer clients, failure to recognize the work potential of cardiac clients, fear of being responsible if death occurs following return to work, lack of recognition that a non-obvious disability may have just as great an impact on a potential client as a clearly visible disability.

Fortunately, there are some positive signs regarding death rates from heart attack. There has been a substantial decline in death rates for both men and women, whites and non-whites, from 1968-74. With a growing population and more patients surviving a heart attack, the potential work force is growing at both ends: young, new workers entering the job pool and older workers with potential disability surviving an illness and being retained in the pool. The counselor's challenge to keep the increasing numbers of productive, post-heart attack patients vocationally competitive is obvious.

Selected Additional Readings

Heart facts. American Heart Association. (Available from your local Heart Association office)

Needs and opportunities for rehabilitating the coronary heart disease patient. National Heart and Lung Institute. DHEW Publication No. 75-750, 1974.

Proceedings of the cardiac seminar. President's Commission on Employment of the Handicapped. U.S. Government Printing Office. No. 0-210-882, 1975.

BASIC ANATOMY AND PHYSIOLOGY OF THE CARDIOVASCULAR SYSTEM

Before one can understand the sources and mechanisms of disability in heart disease, a basic understanding of the anatomy and physiology of the heart is required. Also, the changes in the cardiovascular system resulting from disease will provide a better understanding of the medical problems affecting the cardiac client and the basis for improvement or deterioration. This section is designed to provide the counselor with a basic understanding of the heart and its response to disease and to permit an intelligent reading of medical reports received.

THE HEART

The heart is a muscular organ built on a fibrous tissue framework. It has an electrical conduction system to coordinate the heart beat and a valving system to keep the blood flowing in the proper direction. The heart lies in a fibrous sac, the pericardium, in the lower left center area of the chest and contains four chambers (Figure 1):

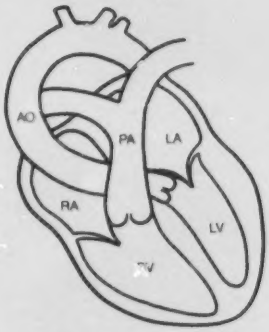


Figure 1. Major structures of the heart.

Blood (venous) from the body enters the right atrium (RA), passes to the right ventricle (RV) and then to the lungs through the pulmonary artery (PA) where carbon dioxide is removed and a fresh oxygen supply taken on. This arterial blood is returned to the left atrium (LA), passes to the left ventricle (LV) from which the blood is pumped into the aorta (AO) and to the body.

Right Atrium

Receives (venous) blood from the body. Venous blood has passed through the tissues of the body, had its oxygen largely removed and has received the primary waste product of body metabolism, carbon dioxide (CO_2). Contracts and ejects its blood across the tricuspid valve into the right ventricle.

Right Ventricle

Is one of the two major pumping chambers of the heart. Pumps venous blood through the pulmonary valve into the lungs where the CO_2 is blown off and a new supply of oxygen (O_2) is received. This oxygenated blood is returned to the heart and is received by the left atrium.

Left Atrium

The other collecting chamber. The oxygenated blood crosses the mitral valve (a 2 cusp valve) into the left ventricle.

Left Ventricle

Is the main pumping chamber of the heart and pumps oxygenated blood into the aorta and then to the arteries of the general or systemic circulation after crossing the aortic valve. The pressure that is measured with a blood pressure cuff and stethoscope is that pressure in these arteries generated by the work of the left ventricle. This is the chamber most commonly affected by major causes of acquired heart disease: atherosclerotic, hypertensive, rheumatic, etc.

The heart also has four valves:

Tricuspid Valve

Three thin, pliable cusps permitting one-way flow from the right atrium to the right ventricle. This valve is occasionally affected by disease.

Mitral Valve

Two thin, pliable cusps directing the flow from the left atrium to the left ventricle. Said to be named "mitral" because while closed it resembles the Pope's mitre if viewed from above. The mitral valve is affected by more conditions than any other valve.

Aortic Valve

Located between the left ventricle and aorta. This valve most commonly requires replacement as a result of chronic rheumatic valvular disease following rheumatic fever.

Pulmonic Valve

Located between the right ventricle and pulmonary artery. Rarely involved in disease.

Coronary Arteries

The heart muscle requires a continuous supply of freshly oxygenated blood as do other tissues of the body. It receives this supply from the coronary arteries. These are the vessels that become diseased with atherosclerosis causing narrowing and obstruction to blood flow with resultant chest pain and heart attack (see section on atherosclerotic coronary heart disease). The major coronary arteries originate from the base of the aorta.

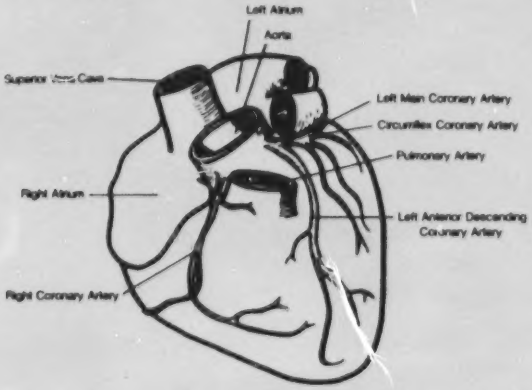


Figure 2. The major coronary arteries as seen from the front surface of the heart.

The right coronary artery takes off directly from the base of the aorta, passes around the heart in the groove between the right atrium and right ventricle.

The left anterior descending coronary artery runs in the anterior groove between the right and left ventricle.

The circumflex coronary artery runs in the groove between the left atrium and left ventricle, similar to the course of the right coronary artery on the right side of the heart. The left anterior descending and circumflex coronary arteries arise from a single, short vessel (about one cm in length), the left main coronary artery. The right coronary artery and left anterior descending coronary artery are generally easier to reach surgically.

Conduction System

The heart's conduction system is responsible for the coordinated

beating of the heart. The generation of the heart beat is an electrical event. Certain of the electrical conduction tissues of the heart have the capacity to generate a beat independently, without an outside stimulus. The tissue that does this most rapidly commands the heart and is called the sino-atrial (SA) node. The impulse passes through the atrial muscle, causing the atria to contract and empty blood into the ventricles. In addition, the impulse is carried to the ventricles which contract shortly after receiving blood from the atria. When blocks in the conduction system occur as a result of disease, the client is apt to have episodes of heart block which produce very slow heart rates and cause black-out spells (syncope) necessitating a pacemaker.

PERIPHERAL (SYSTEMIC OR BODY) CIRCULATION

Arteries

Arteries are characterized by muscular walls and comprise the high pressure portion of the systemic circulation. With constriction of the muscular wall, the resistance against which the heart must pump is increased. Systemic arteries to the head, gut, and extremities are all branches from the aorta.

Arteriole

Arteries continually divide and give off smaller and smaller branches until the smallest artery, the arteriole, is reached. The arteriole is most important in controlling the peripheral vascular resistance. These small vessels branch further into the capillaries.

Capillaries

The capillaries are very small vessels which permit the passage of little more than one red blood cell at a time. Capillaries have very thin walls which permit the red cells to give up their oxygen to the tissues and metabolic waste products to enter the blood. Once this is accomplished, the blood is returned to the heart by the veins.

Veins

The veins begin as very small vessels which become increasingly large as the blood nears the heart. By the time venous blood is returned to the right atrium, there are only two systemic veins: the superior vena cava (draining the head, neck, upper chest and arms) and the inferior vena cava (draining the lower chest, abdomen, gut and legs).

PULMONARY (LUNG) CIRCULATION

Pulmonary Artery

The pulmonary artery receives venous blood returned from systemic veins to the right side of the heart and distributes it to the lungs. The pulmonary artery divides into two main branches, right and left, to the right and left lungs, respectively. The arteries continue to subdivide, similar to the systemic circulation, until the pulmonary capillaries are reached.

Pulmonary Capillaries

The pulmonary capillaries run in the walls of the smallest air sacs of the lung, the alveoli. As with the systemic circulation, it is at the capillary level where gas transfer takes place. The capillary and alveolar walls are extremely thin, permitting rapid diffusion of oxygen and carbon dioxide across the membranes. Carbon dioxide is released and exhaled and oxygen is taken up by the red blood cells in preparation for another trip through the systemic circulation.

Pulmonary Veins

Freshly oxygenated blood is collected by a decreasing number of pulmonary veins of increasing caliber as the heart is reached. Ultimately two veins from each lung reach the left atrium and the trip through the systemic circulation is started again.

DISTRIBUTION OF CARDIAC OUTPUT

Blood is distributed to the organs of the body in such a way that oxygen demands of the organ are met both at rest and during exercise. These demands may be met by increasing flow to the organ or by the organ extracting more of the oxygen available with each circulation.

The distribution of systemic blood flow and percent of total body oxygen consumption is shown in Table 1. Note that the kidneys receive a high proportion of flow in order to filter waste products, but use relatively less oxygen to accomplish this task. On the other hand, the brain, skeletal muscles and heart extract a greater amount of oxygen from the blood which passes through the organ, resulting in a substantial portion of total body oxygen consumption. These three circulations receive 38 percent of total flow and use 61 percent of the total oxygen consumed.

CIRCULATION	% of total flow	% of total O_2 consumption
Gut	24	25
Kidneys	19	7
Brain	13	20
Coronary	4	11
Skeletal muscles	21	30
Skin	9	2
Other organs	10	5
TOTAL	100	100

Table 1. Distribution of systemic blood flow to different organs and percent of total oxygen consumption. Subject at rest in a comfortable environment. Modified from Wade and Bishop.

With mild to moderate exercise, coronary blood flow and flow to exercising muscles increases, cerebral (brain) flow is maintained and flow to the kidneys and gut falls. With more severe exercise, these changes are magnified and with maximal, exhausting exercise, flow to the brain may decrease. Flow to inactive skeletal muscle will drop as well at high levels of exertion.

RESPONSES OF THE HEART TO STRESS

The heart has several ways in which it can respond to a demand of the body for more blood. Some of these occur in normal people during exercise or anxiety. Others require an abnormal state of some duration before the response is apparent. All of the mechanisms may ultimately fail, doing more harm than good if not corrected. The common responses to stress include: increase in heart rate, dilatation of heart chambers, hypertrophy of heart muscle and release of adrenal gland substances (catecholamines).

Heart Rate

Heart rate may be an almost immediate response to stress. The benefit (or detriment) to be derived from an increase in heart rate is related to:

Age — Maximum heart rate capability decreases with advancing age. For example, the average maximum rate which can be achieved for one 25 years old is approximately 200 beats/minute, whereas the maximum for one 65 years old is 153 beats/minute. Clearly, if one has a heart rate faster than that which can safely be sustained for a period of time, the heart may not function optimally as a pump.

Condition of the Coronary Arteries — If there is significant obstructive coronary artery disease, then their flow may be inadequate to meet the heart's oxygen needs when the heart is called upon to do more work; either to beat more rapidly, against higher resistance (blood pressure) or with more force (tension) — these are the major determinants of how much oxygen the heart demands to accomplish its pumping task. Inability to meet oxygen demands of the heart may cause chest pain (angina pectoris), heart attack, heart failure or occasionally sudden death.

Condition of the Heart Muscle — If the heart is weak in the sense that it cannot contract forcefully or if a substantial portion of heart muscle is replaced by scar tissue (which is strong, but cannot contract) then increasing the heart rate will not improve cardiac output. The situation is analogous to whipping an exhausted animal — you can't make it accomplish any more work and will only increase its fatigue.

Dilatation

Represents stretch of the individual heart muscle fibers and takes hours or days to develop. The relationship between cardiac output and stretch (dilatation) is shown in Figure 3. Cardiac output rises with increasing dilatation and then decreases when stretch becomes excessive. At this point the value of the mechanism has been exceeded. Since tension is one of the major determinants of heart muscle oxygen demand, then an increase in radius (stretch) will increase wall tension and increase the oxygen required to do the pumping work. If the coronary arteries are significantly obstructed, this increased oxygen requirement may not be met and angina, heart failure, arrhythmias and occasionally heart attack may follow.

Figure 3. The Frank-Starling relationship between cardiac output and dilatation (stretch). When dilatation becomes excessive, it is no longer a useful mechanism, and cardiac output falls.

Hypertrophy

After considerable time working against an increased load, the individual heart muscle fibers may increase in size and strength, that is, hypertrophy. This also is a good mechanism up to a point — the point at which the muscle fibers get so large that they virtually outstrip the available blood supply. This may take a variable period of time — from months to years and perhaps never during the client's life. However, if this does occur, the myocardium becomes ischemic and cannot tolerate stress — the end result is the same: heart failure and other complications of myocardial ischemia.

Catecholamines

These are substances like adrenaline and nor-adrenaline produced by the adrenal glands in response to stresses, including anxiety. They are available almost immediately and may remain if the stress continues. Catecholamines increase the heart rate, blood pressure, force of contraction, and venous return to the heart. These effects cause an increase in the heart's oxygen requirement, a potentially expensive price to pay if blood flow through the coronary arteries is marginal.

When the responses of the heart to stress become ineffective, then the heart has failed as a pump and heart failure has occurred. This is best and simply defined as the inability of the heart to discharge its contents adequately to meet the body's requirements for blood. The symptoms of heart failure are discussed under causes of disability.

CAUSES OF CARDIAC PAIN

Pericarditis

Pain related to heart disease is usually from one of two sources:

inadequate oxygenation of heart muscle (ischemic pain) or inflammation of the pericardium, the fibrous sac that envelops the heart. Interestingly the pain of pericarditis (the suffix -itis always indicates inflammation) is usually similar and often indistinguishable from ischemic pain. At other times, pericardial pain is synchronous with breathing in.

Ischemic Pain

By far the most important form of cardiac discomfort and one of the major sources of cardiac disability is ischemic pain which occurs when oxygen supply to the myocardium fails to meet oxygen demand. The discomfort caused by myocardial ischemia is called *angina pectoris* (literally, pain or burning in the chest). Angina is usually described as a pressure, weight, tight or constricting sensation located behind the lower sternum (breast-bone) often radiating to the inner aspect of the left arm. Other areas of radiation include the neck, through to the back, to the right arm, the elbows, and wrists. Symptoms associated with angina may include nausea, vomiting, weakness, cold, clammy sweating, shortness of breath and anxiety.

Angina is commonly precipitated by exertion, emotional distress, cigarette smoking, intercourse, following a meal, or on exposure to cold. Angina is transient, remitting when the inciting factors are removed or if nitroglycerin is taken. It does not represent death of heart muscle cells as occurs with heart attack.

The pain of *heart attack* is similar in every regard to that of angina, but is usually much more severe, lasts longer, usually requires narcotics for relief and is not relieved by nitroglycerin. Heart attack is generally caused by occlusion of a coronary artery with resultant death of heart muscle tissue (myocardial infarction).

CAUSE OF RHYTHM ABNORMALITIES

Abnormal rhythms (arrhythmias) are particularly common in heart disease and are also seen, but less frequently, in persons in good health. Changes in the heart rhythm may be caused by several factors: ischemia of heart muscle, low oxygen in the circulating blood, heart failure, drugs (especially digitalis and adrenaline-type drugs), and stimulants including caffeine (coffee, tea, cola), nicotine, and amphetamines.

Selected Additional Readings

Gorlin, R. Coronary artery disease. Philadelphia: W. B. Saunders Co., 1976.

Hurst, J. W., Logue, R. B., Schlant, R. C., and N. K. Wenger. The heart. McGraw-Hill, 4th Edition, 1978.

Netter, F. H. The CIBA collection of medical illustrations. Volume 5: The heart. CIBA Pharmaceutical Co., 1969.

Phibbs, B. and others. The human heart - a guide to heart disease. St. Louis: C. V. Mosby Co., 3rd Edition, 1975.

TYPES OF HEART DISEASE

The heart may be affected by many diseases, both primarily and secondarily as a target organ of involvement in another disease. Conditions discussed in this section will provide an overview of the major types of heart disease. Not all forms of heart disease will be covered. It is important to recognize that virtually any form of heart disease may be associated with disabling symptoms, which from the counselor's standpoint, are most important in making sound counseling decisions. These causes of disability are reviewed in the next section.

A simple and useful way to look at heart diseases is whether the condition is congenital or acquired.

CONGENITAL HEART DISEASE

Congenital heart disease is present at birth. Fortunately, it is relatively rare, occurring in about 0.5% of live births. There are two major subgroups of congenital heart disease: cyanotic and acyanotic.

Cyanotic

Cyanotic congenital heart disease is characterized by a blue color of the lips and nail beds. The heart defects are often complex and death often occurs early in life. However corrective surgical procedures are rapidly improving so that children will reach employment age. Children with cyanotic congenital heart disease often have a psychological problem in childhood because of their blue and therefore different appearance, physical restrictions, and over protection by parents and teachers.

Acyanotic

Children with acyanotic congenital heart disease have a normal color. Their appearance does not differentiate them from normals and their functional capacity is more apt to be normal or nearly so as well. The degree of functional incapacity is related to the size of the defect and amount of blood shunted between right and left heart chambers or the degree of obstruction to blood flow. Common forms of acyanotic congenital heart disease include defects in the atrial and ventricular septae, patent ductus arteriosus (open connection between the pulmonary artery and aorta present before birth so that blood can bypass the lungs in utero) and coarctation of the aorta (constriction of the

aorta, usually in the chest, so that blood pressure is much higher in the arms than the legs). Surgical correction of these defects is less complex and highly successful. Life expectancy and vocational outlook is excellent for most, especially after surgical correction.

ACQUIRED HEART DISEASE

Acquired heart diseases are those that develop during life. Conditions discussed here will comprise the majority of the counselor's case load of people with heart disease. The most important problem by far, atherosclerotic coronary heart disease, will be discussed in greater detail. Diseases to be reviewed include:

— atherosclerotic coronary heart disease
— hypertension
— rheumatic heart disease
— pericardial disease
— primary myocardial disease
— pulmonary heart disease
— trauma to the heart
— endocardial disease
— other forms of heart disease

ATHEROSCLEROTIC CORONARY HEART DISEASE

Atherosclerotic coronary heart disease is a common disorder that begins early in life, has a complex cause, is progressive and may cause both acute and chronic disability. As the disease develops, fat is deposited in the inner layer (the intima) of a coronary artery in increasing amounts. This deposit begins as a small, flat fatty streak and progresses to produce varying degrees of obstruction of the artery. The artery responds to the fat deposit by forming scar tissue. The atherosclerotic plaque is ultimately formed of fat, scar tissue, calcium, and inflammatory cells. Figure 4 shows different degrees of narrowing of the interior of a coronary artery by atherosclerosis. Atherosclerosis is well tolerated and produces no symptoms until significant obstruction has occurred. This asymptomatic "incubation period" may last for many years before symptoms and therefore disability occur. With advanced narrowing of the artery, the amount of oxygen brought to the heart muscle beyond the obstruction may be insufficient — oxygen demand exceeds oxygen supply and symptoms appear (see section on causes of disability). The economic and vocational impor-

tance of coronary heart disease warrants a more detailed account of the illness.

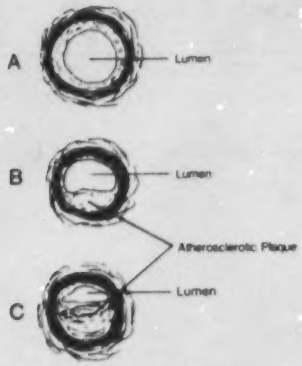


Figure 4. Coronary arteries in cross section.

A — Normal. No narrowing; no atherosclerosis.

B — Slight (<50%) narrowing due to atherosclerosis. This client would not have symptoms.

C — Moderately severe obstruction. The client would be comfortable at rest but would likely experience angina pectoris with exertion.

Terms

Many terms are used to indicate that the patient/client has atherosclerotic coronary heart disease (ACHD). However, none is as specific as atherosclerotic coronary heart disease which indicates the pathologic process (atherosclerosis), the structure involved with the process (coronary arteries), and the heart is affected to a sufficient degree to cause disability (disease).

Other terms often used include: ischemic heart disease (IHD), coronary artery disease (CAD), arteriosclerotic heart disease (ASHD) and coronary heart disease (CHD).

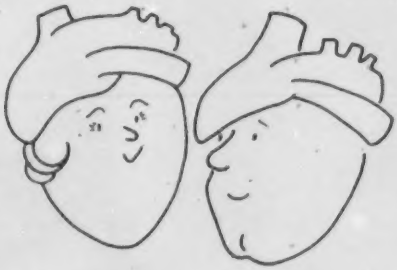
Risk Factors

Over the past several years it has become apparent that atherosclerotic coronary heart disease is not caused by a single factor but rather is the result of multiple factors working alone or in combination. Some of these risk factors cannot be modified; others can. It is part of the counselor's job to understand the risk factors possessed by

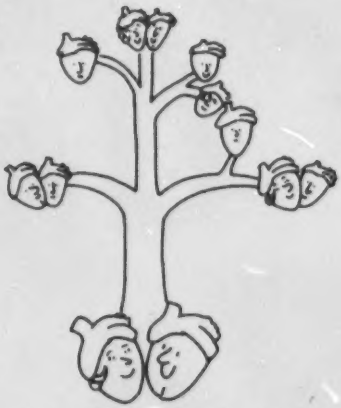
the client and to assist the client in maintaining a life-long program of risk factor modification. ACHD is one illness that demands that the patient/client participate in his own care if natural history is to be modified. The counselor can assist in the reinforcement of client participation through encouragement of the client's adherence to a risk factor modification program. If the counselor identifies that the client is not informed of his risk factors, the subject should be introduced and the client referred to his physician for a plan of risk factor management. Space does not permit a full discussion of each factor, but a list of the major ones with a brief discussion of each will help to achieve the necessary understanding.

Age — Cannot be modified. The incidence of ACHD increases with advancing age although heart attacks are not uncommon among persons in their 30's and occasionally strike a person in his 20's.

Sex — Cannot be modified. At all ages the prevalence of ACHD is greater in men than in women. However, later in life the prevalence in women increases and approaches that of men.



Heredity — Cannot be modified. To a large extent we are all what our genes and heritage dictate we shall be. Several of the risk factors may be inherited: hypertension, high blood cholesterol, high blood triglycerides, and diabetes. In addition, there are certain families that have few, if any, of the major risk factors yet have a very strong family history of premature atherosclerotic coronary heart disease. In this instance, heredity or an as yet unidentified inherited risk factor must be responsible.



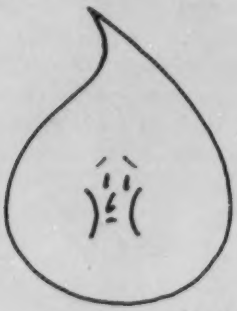
Smoking — A major risk factor about which something can easily be done. Cigarette smoking alone increases the risk of developing ACHD by a factor of two.

Hypertension — High blood pressure, like cigarette smoking and high blood cholesterol, is a major risk factor. It is estimated that

there are approximately 25 million people in the United States with high blood pressure. There is a steady increase in risk of developing atherosclerotic coronary heart disease with increasing blood pressure. One of the major problems with high blood pressure is that it does not cause symptoms until very late in its course. Therefore, a regular blood pressure check in apparently normal individuals is the only way this disease will be properly detected. In most cases of high blood pressure there is no apparent cause. This form of high blood pressure is called essential hypertension. In about 5 percent of instances there is a clearly defined cause which can be treated and the hypertension cured. Generally, once an individual has firmly developed essential hypertension it does not spontaneously remit and life-long treatment of the condition is required.

Blood fat — Two fat elements in the blood are thought to be important in the cause of ACHD. There is little doubt that high blood cholesterol is an important risk factor. There is less certainty about the role of triglycerides. Many cases of high blood cholesterol can be controlled by diet and perhaps by regular exercise. Occasionally, medications are required. The diet necessary to help control high blood cholesterol is one with a decreased quantity of saturated fat (solid at room temperature), increased intake of polyunsaturated fat (liquid at room temperature), and involves decreasing the intake of eggs, whole milk products, foods derived from animal organs and red meat. High blood triglycerides are

often induced by a diet high in refined sugars and usually can be controlled by eliminating these items from the diet.



Physical inactivity — Is probably a significant risk factor. Although it has not been definitely proved, there is suggestive evidence that regular exercise is valuable in both primary and secondary prevention of ACHD.

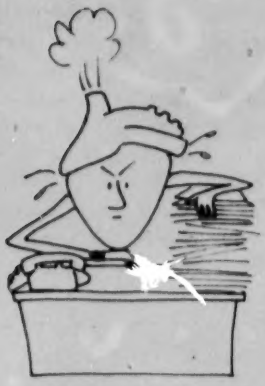
Carbohydrate intolerance — The most florid form of inability to handle sugar is diabetes. There are other persons who do not have diabetes but who handle sugars inadequately or inappropriately. These individuals are also thought to be at an increased risk of developing ACHD. The diabetic has a greater risk of developing arterial disease not only of the heart but of the eyes, kidneys, brain

and vessels throughout the body. There is no good evidence that controlling the blood sugar in a person with diabetes decreases the likelihood of complications of the disease.

Diet — The American diet is too high in calories, saturated fat and refined carbohydrates. It is associated with an increased incidence of high blood fats, diabetes, obesity, hypertension, and ACHD. A prudent diet is modest in calories so that it permits one to achieve and maintain an ideal body weight, is low in saturated fats higher in polyunsaturated fat and low in refined carbohydrates.

Obesity — Excessive body fat is not a primary risk factor for coronary heart disease, but exerts its effect through its association with increased blood fats, diabetes and hypertension.

Personality and behavior — There is some evidence that suggests that one's personality, response to stress and approach to living may be an important risk factor (personality Type A). The Type A person is characterized by being physically and mentally alert, continuously involved with deadlines, time conscious, goal oriented, competitive and concerned with acquiring material things. The Type A person will often overschedule a day, be unable to meet some of the commitments, and become frustrated and angry. Then, in order to catch up he will jam the next day's schedule even fuller, only to meet the same problems of frustration and anxiety again. The Type A person can truly be said to have "time sickness."



It appears that those who are not well equipped to handle stress and whose coping patterns are noticeably maladaptive are at greater risk for developing ACHD. Further, those with most serious psychological deficits are more likely to be the early fatalities of ACHD. Aside from these generalizations, there is little explicit information to go on, and much remains to be learned to clarify the relation of personality to the cause of ACHD.

Rehabilitation workers should not accept a simplistic view of this issue, for even the generalizations mentioned above probably do not differentiate the person who develops ACHD from those who develop cancer, arthritis, ulcers or any other chronic illness.

Electrocardiogram changes — Abnormalities in both the resting and exercise electrocardiogram are correlated with an increase in risk of having a coronary event. These changes include evidence of enlargement of the left ventricle and abnormal repolarization at rest or with exercise.

Clinical Presentation

Angina pectoris — The pain of ACHD is quite characteristic and is related to an imbalance in oxygen supply and demand to a portion of the heart muscle, the discomfort it produces is termed angina pectoris. Angina is usually described as a constriction, pressure, weight, burning or heaviness in the chest commonly located behind the breast bone. Anginal discomfort may radiate into the jaw and through to the back, down both arms, but most characteristically radiates down the inner aspect of the left arm. Angina is often associated with weakness,

shortness of breath, nausea and a cold, clammy sweat. In the susceptible person it is often precipitated by physical exertion or emotional upset; it occurs more easily after a large meal, after smoking a cigarette, during or after sexual intercourse and on exposure to cold air. Angina is relieved by getting out of the precipitating situation and taking medication to decrease the work of the heart or improve the oxygen supply to the involved portion of the heart muscle. A nitroglycerin tablet dissolved under the tongue is usually used for this purpose. Angina occurs in two forms: stable and unstable. Stable angina is predictable as to its occurrence and relief. Unstable angina, on the other hand, occurs with increasing frequency, requires less of any precipitant to induce it, and requires more nitroglycerin for its relief. When angina changes character in this fashion, it is an ominous situation and medical advice should be sought.

Myocardial infarction — Infarction means death of muscle due to inadequate blood supply; myocardium is heart muscle. Myocardial infarction (MI) is synonymous with heart attack. Most heart attacks present pain that is similar to that of angina but which is much more severe and is not relieved by nitroglycerin. Usually narcotics are required before relief is complete. Interestingly, 15 to 20 percent of heart attacks are silent; that is, they are not associated with pain.

Sudden death — A significant percentage of people with ACHD die without warning. Sudden death is usually due to an abnormality of heart rhythm (cardiac arrest). Cardiac arrest may be associated with a heart attack. It does not require a large area of heart damage for cardiac arrest to occur; a very small area can cause an arrest. The fact that a client has survived a cardiac arrest does not mean that he is less capable to work effectively. This client should be evaluated and managed by the counselor as any other client.

Heart failure — The inablity of the heart to fully meet the demands of the body for blood, that is, insufficiently do its job as a pump, may be the initial presentation of ACHD and it is discussed in detail in the section of "Causes of Disability" from cardiac disease.

Other — Additional presentation of ACHD may include abnormalities of heart rhythm, pulmonary embolism (a blood clot from the veins which moves into the lungs) and occasionally an arterial embolus, a blood clot in one of the arteries to the brain (stroke) or elsewhere in the body.

Natural History

Angina pectoris — The death rate from angina pectoris varies between 4 and 9 percent per year. It is probably better to look at mortality from ACHD from a standpoint of number of coronary arteries involved since the more vessels involved the more likely one is to die. Single vessel coronary disease mortality is approximately 4 percent per year; in two vessel involvement, mortality is 8 percent per year; and with three vessel disease, 12-15 percent per year. Therefore, cardiac catheterization and coronary angiography give useful prognostic information that may be helpful in vocational planning.

Myocardial infarction — The natural history of heart attack depends on the age at which the attack occurred, the extent of the infarct, the number and severity of complications associated with the attack and the degree to which the patient works in his/her own behalf to modify risk factors and prevent additional episodes. Of those that have a heart attack, 70 percent will have a repeat episode and approximately one-half will have residual angina pectoris. If the attack occurs before age 50, and is survived, 60 percent will live an additional 10 years or more. On the other hand, if one is over 50 years at the time of the attack only one-third will live 10 or more years.

Coronary artery bypass surgery — The impact of this important surgical procedure on the natural history of ACHD is not clear at this time. Angina pectoris is usually improved following surgery and there is evidence that mortality for those with severe obstructive disease of the left main artery or its equivalent (high grade obstructions in the proximal left anterior descending and circumflex coronary arteries) or multiple vessels disease is improved.

The counselor must understand that the saphenous vein bypass operation does not remove the atherosclerotic obstruction in the coronary arteries nor does it prevent further growth of the plaques. Occasionally clients will express a belief that they have been cured as a result of the surgery. This simply does not occur. ACHD is a dynamic, progressive process that is not arrested by surgery. The principles of a comprehensive approach to prevention of the disease apply for the surgery patient as for the patient managed medically.

HYPERTENSION

Hypertension is a major ACHD risk factor and is an important cause of death in the United States. In addition to the heart, the eyes,

kidneys, and brain may be affected by hypertension.

Blood pressure tends to rise modestly with age. Average normal adult blood pressure is 120/80. The upper value is termed systolic blood pressure and the lower value, diastolic. Hypertension is defined as blood pressure of 140/90 or greater obtained on at least three separate occasions, the pressure taken at seated rest. Some clients will have labile blood pressure: the pressure is normal at times and elevated at others. Persons with labile hypertension may be at risk for developing fixed hypertension later on.

Treatment of hypertension is often, perhaps usually, given when the diastolic pressure is consistently greater than 100. At diastolic pressures above 115 therapy becomes more urgent. Adequate antihypertensive therapy will usually bring the blood pressure to, or close to normal. A diastolic pressure of 90 or less is a desirable, but not always possible goal. Antihypertensive medications are potent and can be associated with many side effects — either from lowering the blood pressure (symptoms of orthostatic hypotension) or direct effects of the drug and effects on body chemistry. Included in the latter group of side effects are symptoms of low blood potassium (weakness, rapid heart action, muscle cramps, difficulty thinking). The section on medications should be consulted for side effects of specific drugs.

Hypertension is usually not associated with symptoms until late in the course of the illness. When symptoms occur, they are a reflection of involvement of one or more of the target organs that may be damaged by hypertension. Symptoms that may occur are headache, visual blurring, chest pain, decreased urine output, seizures, nose bleed, and symptoms of heart failure.

Proper treatment of hypertension with relief of symptoms (if any) and a return of blood pressure to acceptable levels does not mean that the disease is cured, only that it is controlled. The client must remain on medication and obtain long-termed follow-up care. Clients who are properly managed and without symptoms are not usually limited at work and should be encouraged to continue employment.

In addition to the impact of hypertension as a risk factor in ACHD, high blood pressure may have a more direct adverse effect on the heart muscle. As a result of many years of pumping against high resistance in the systemic arteries, the left ventricle enlarges, and individual muscle fibers become larger and work harder (hypertrophy — much like the skeletal muscles of a weight lifter). Eventually,

the heart may not be able to tolerate this increased workload and symptoms of heart failure and arrhythmias appear (see section on Causes of Disability).

RHEUMATIC HEART DISEASE

Fortunately, chronic scarring of the heart valve as a result of acute rheumatic fever is becoming less common. When it does occur, however, it may be a very important problem for the client. Acute rheumatic fever usually occurs between the ages of 7 and 12 but the resulting valvular disease does not cause problems until the third decade of life or later. The scarring of the valve may affect it in one of two ways. It may cause stenosis or incomplete opening of the valve which causes obstruction to blood flow across the valve or the valve may become insufficient, not close properly, and therefore leak. The most commonly involved valves are the mitral, aortic, and tricuspid in that order. The pulmonary valve is rarely affected. With the development of good materials for artificial valves, heart-lung machines to support circulation during surgery and new surgical techniques, severely damaged valves can be either repaired or replaced with relatively low risk, and the client's ability to continue employment can be maintained. Most patients with artificial valves are on anticoagulants (medications that prolong blood clotting time) so that a task that involves a high probability of injury, especially cuts, should be avoided.

PERICARDIAL DISEASE

The heart lies in a fibrous sac, the pericardium, within the chest. When the pericardium is involved with a disease it is usually inflamed and painful. Inflammation of the pericardium is termed pericarditis. There are many causes of pericarditis, the most common of which are viral and non-infectious forms which follow a heart attack or open heart surgery. With increasing numbers of open heart surgical procedures being performed, this form of pericarditis, the so-called post-cardiotomy or post-pericardiotomy syndrome is becoming increasingly common. The condition is benign and can usually be treated with anti-inflammatory medication such as aspirin.

Viral pericarditis is usually a benign acute illness with which the rehabilitation counselor is not involved. Occasionally pericarditis results in a very heavy pericardial scar which constricts the heart resulting in long-term disability much like chronic heart failure.

PRIMARY MYOCARDIAL DISEASE

The myocardium or heart muscle may be involved in many diseases. It may be inflamed as a result of viral or bacterial infection, a myocarditis. More important is a collection of primary muscle diseases of unknown cause, the cardiomyopathies, which cause considerable disability through heart failure and abnormalities of rhythm and for which little can be done. Some patients with primary myocardial disease will do well for many years and will remain able to work for prolonged periods.

PULMONARY HEART DISEASE

This refers to cardiac problems which are a result of primary lung disease, usually chronic bronchitis and/or emphysema (chronic obstructive pulmonary disease). When sufficient lung tissue is destroyed as a result of disease, the number of blood vessels into which the right ventricle can pump blood decreases. This increases the resistance against which the right ventricle must work and eventually the ventricle may fail. When this occurs, pressures rise in the right ventricle, the right atrium and in the venous system causing congestion in many tissues and organs. Fluid may leave the veins causing swelling (edema) in lower portions of the body, fluid may accumulate in the abdomen (ascites), and the liver may become enlarged and tender.

TRAUMA

Injury to the heart is usually caused by closed chest trauma primarily due to steering wheel injuries at the time of an automobile accident. The heart may become bruised and occasionally may rupture. The bruised or contused heart will heal and should not compromise one's ability to work. A ruptured heart, unless repaired immediately, usually causes death. Occasionally an individual has been involved in a fight and had an ice pick or knife stuck in the heart and survived the event. These clients should be able to work without limitations.

ENDOCARDIAL DISEASE

The endocardium is composed of the inner surface of the heart and the heart valves. The primary disease affecting the endocardium is bacterial endocarditis, a bacterial infection of one or more of the heart

valves. When this occurs, the valve leaks increasing the volume of blood a heart chamber must handle. As a result of this increased volume load, heart failure occurs rather quickly. In spite of the enormous advances made in the development of new and better antibiotics, the mortality from bacterial endocarditis remains about 50 percent. On occasion, a valve will have to be replaced before the infection is under complete control, a procedure that can be done safely and effectively. Once the infection is controlled and the valve replaced (if necessary) the vocational outlook for the recovered patient with endocarditis should be good.

OTHER FORMS OF HEART DISEASE

The above is a brief review of some of the more common heart diseases the rehabilitation counselor will encounter. Although less likely to be seen, the counselor should understand that there are many more types of heart disease including disease secondary to cancer, associated with endocrine disease (thyroid and adrenal glands), collagen-vascular disease, vitamin deficiencies, alcohol, syphilis, various poisons, and some arthritic disorders to mention a few.

Selected Additional Readings

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Netter, F.H. The CIBA collection of medical illustrations. Volume 5: The heart. CIBA Pharmaceutical Co., 1969.

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CAUSES OF DISABILITY IN CARDIAC DISEASE

Disability from a disease may be related to the symptoms caused by the illness, or physical or emotional limitations imposed by the disease. For the client with cardiovascular disease, the disability is hidden, invisible to others. This is contrary to the obvious disability of many handicapped citizens. The hidden disability may pose problems to the client when performance expectations are high but cannot be met — often with resultant misunderstanding on the part of the supervisor or employer.

Common major disabilities in heart disease include heart failure, pain, arrhythmias, and psychosocial upset. One additional consideration is that many heart problems are life threatening, especially coronary heart disease. The client often lives with the knowledge that death can occur at any time, without warning, at work, play or at rest. Fortunately, this knowledge rarely causes disabling emotional problems — most cardiacs are able to accept the threats of the illness and deal with them constructively.

HEART FAILURE (Congestive heart failure)

When the heart is stressed by disease the initial response is to increase heart rate and maintain the force of contractions through an outpouring of catecholamines from the adrenal gland. Later, dilata-

tion occurs and eventually the muscle fibers hypertrophy. As discussed earlier, these responses of the heart to stress are useful to a point. When that point is exceeded the heart fails to respond adequately to the demands of the body for blood and heart failure has occurred.

PULMONARY VASCULAR CONGESTION

Pulmonary vascular congestion is one of the main sources of disability in heart disease and is usually caused by left heart failure. The symptoms of pulmonary vascular congestion are:

Dyspnea — Or shortness of breath. This may occur at rest or be brought on with exertion and is a common symptom of pulmonary vascular congestion. When the left ventricle fails or when there is obstruction to emptying of the left atrium, the pressure in the left artrium rises. This increased pressure is reflected through the pulmonary veins (which bring freshly oxygenated blood from the lungs) to the lung vessels, causing them to be congested.

Orthopnea — The inability to lie flat because of shortness of breath, another common symptom of pulmonary vascular congestion.

Paroxysmal Nocturnal Dyspnea (PND) — Is awakening in the middle of the night acutely short of breath. This is usually described as intense shortness of breath occurring 2-3 hours after going to bed. The client awakens acutely short of breath and is forced to sit up for a period of time before the symptom goes away. Not uncommonly the client will go to the window or an open door in an effort to get more air. The whole episode usually lasts between 15 and 30 minutes.

Cough — A newly appearing cough, usually dry and hacking in character, may indicate pulmonary vascular congestion and pump failure. Occasionally the cough produces sputum, but usually not.

Acute Pulmonary Edema — Is sudden filling of the breathing spaces in the lung (alveoli) with fluid as a result of a marked increase in pulmonary vascular congestion. In this situation the individual is literally drowning in his/her own fluids, a life-threatening situation.

In contrast to pulmonary vascular congestion due to left ventricular failure, when the right ventricle fails, pressure in the veins rises causing

congestion of tissue and engorgement of organs, particularly the liver. The veins at the side of the neck will often become prominent, as will those on the back of the hands and in the arms. Fluid may accumulate in the abdomen (ascites) and swelling (edema) of the lower portions of the body may occur. There are no specific symptoms related to congestion of tissues and organs except that congestion in the liver is often associated with a feeling of fullness in the right upper portion of the abdomen. Appetite may be decreased and a feeling of nausea may be present.

LOW CARDIAC OUTPUT

When the heart fails, the amount of blood that it pumps per unit of time falls. There is a group of nonspecific symptoms associated with a decrease in cardiac output or low cardiac output which are often neglected by the client's family, friends, associates, and even by his physician. These symptoms are entirely nonspecific. They include: fatigue, lethargy, apathy, weakness, mental disturbance, poor memory, feelings of depression and a sense of deterioration, that things are generally not going well. The symptoms of low cardiac output are present in situations where either the right or left ventricle has failed.

The client with acute heart failure must markedly limit activity in order to provide as much rest as possible for the heart during the time the condition is being treated and brought under control. This limitation includes work, even sedentary jobs, in order to ensure maximal rest for the heart. The client with chronic heart failure who is on optimal medical therapy will have to limit strenuous physical activity and should be in a work situation where tasks can be paced and a rest period arranged for, if needed.

ARRHYTHMIAS

Abnormalities of heart rhythm (arrhythmias) may cause symptoms related to the heart and other body organs. Cardiac output may fall with rhythms that are either too rapid or too slow. It may also fall as a result of frequent early beats that do not pump blood effectively. In addition to decreasing blood flow to many organs, the blood supply to the myocardium may decrease.

SOME SYMPTOMS THAT MAY BE ASSOCIATED WITH ARRHYTHMIAS

Heart Failure
— pulmonary vascular congestic
— low cardiac output

Palpitations
— fewer than 50% of clients with significant arrhythmias are aware of the change in character of the heart beat.

Angina Pectoris

Neurological Symptoms
— focal or diffuse transient muscular weakness, visual, speech difficulties, confusion, convulsions.

Decreased Urine Output

Fainting Spells, Light Headedness, Dizziness

Certain types of rhythm disturbances are very common in normal hearts, pose no threat to health and are no limitation to any job. Their main significance is the anxiety that may be created in the individual who is not aware that the rhythm disturbance has no serious meaning.

PAIN

The major cause of heart pain is an inadequate supply of oxygen to meet the demands of the myocardium, that is, ischemic pain. This has been described in the section on atherosclerotic coronary heart disease in the paragraphs on angina pectoris and myocardial infarction. Pericardial discomfort usually mimics that of angina pectoris although when the surrounding surface of the lung is involved then pain present with breathing in is experienced as well.

Once a person knows he has heart disease, then virtually any discomfort in the area of the chest may be interpreted as coming from the heart. Most people have chest discomfort of one form or another periodically throughout their lives and until an acute coronary episode has occurred these discomforts are disregarded. Many of these pains come from the chest wall and can be identified by their being increased by motion of the chest wall or increased by direct pressure over the area of the discomfort.

When angina pectoris is produced by work, some form of job change is required: eliminating the inciting task(s), application of work simplification principles to the job, slowing the pace of work and occasionally, a complete change of jobs. Before this is done, however, the client should learn to use nitroglycerin before any task that is likely to produce angina (prophylactic use of nitroglycerin) and the job should be carefully reviewed for ways it can be modified so that the client will not require retraining to another vocation. If the client has angina on the job that is not relieved by rest and three nitroglycerin tablets taken five minutes apart, immediate medical attention must be sought.

PSYCHOSOCIAL ADAPTATIONS

Regardless of the clinical form of heart disease, psychosocial elements are of great importance in the conduct of the client's life. Acute myocardial infarction is especially devastating because one cannot select a "best time" to have a heart attack and the event is always a shock and poses major psychological problems in many patients.

ACUTE ILLNESS

The initial critical phase of psychological and social stress with an acute cardiac episode involves the patient and family in accommodating to the stresses of a life-threatening crisis, in adapting to hospitalization and the coronary care routine, and in uncertainty regarding recovery and rehabilitation.

Fear & Anxiety

There is general agreement that if following the acute cardiac event the patient is admitted at once to a coronary care unit (CCU) and survives the first 24 hours, the chances of recovery and rehabilitation are excellent. Nevertheless, the initial episode is accompanied by obvious fear and apprehension in patient and family alike. The risk is great at this point of emotional stress and upset, of both patient and family regrettably being affected by misinformation and the misinterpretation of information. Counselors should become knowledgeable concerning the psychological stresses and reactions that their clients will have already gone through.

Delaying Treatment

If it happens that the patient has experienced physical symptoms for hours or perhaps days before the acute cardiac event, he or she invariably has been in a state of conflict and uncertainty during this period. Pain, shortness of breath and dizziness are symptoms which are universally fear-provoking and the patient's response to this generally rests upon his conception of the relative attractiveness or unpleasantness of the alternatives. Vacillation between seeking and avoiding treatment and hospitalization is common and always increases emotional stress to the detriment of the patient. Most often, patients who delay seeking treatment do so not only out of fear, but also because of negative expectations concerning possible hospitalization, including high costs. Frequently, too, an unrealistic denial mechanism of coping is seen in patients who delay treatment in that they often ascribe the distressing symptoms to a benign cause, i.e., to overwork, fatigue, indigestion, and the like.

CCU Environment

Once admitted to the CCU, the stresses of fear and uncertainty are far from past. In this situation the patient and family are likely to be influenced by extraneous, irrelevant, and perhaps even erroneous information. Actions or remarks by the CCU staff are frequently misinterpreted or exaggerated, no matter how casual or even unrelated this information may be. Often such occurrences are unavoidable, yet a great deal of later difficulty could be circumvented by some thoughtful, compassionate, honest communication with the patient and family in the first few hours of the acute cardiac episode. The patient may later remember and be able to repeat the earliest statements and actions made toward him by the staff, whereas more recent and perhaps more accurate messages will have been forgotten.

Sensory and social isolation as well as restricted mobility are, in addition to the other trauma of the CCU environment, serious sources of deprivation and stress which are capable of producing an intense, disturbing sense of depersonalization in up to 20 percent of myocardial infarction and cardiac surgery patients. Even the most psychologically healthy individual is hard pressed to cope with this situation. The syndrome has come to be known as "CCU psychosis" or "post-cardiotomy delerium," and is a transient reaction in all but rare instances. Typically, patients undergo progressive intense feel-

ings of unreality and depersonalization, strange and disturbing bodily sensations and illusions, and occasionally auditory or visual hallucinations. Quite naturally, when these symptoms occur, patients become increasingly disturbed and fear they are losing their minds. Family members who find the patient uncommunicative or incoherent are also greatly distressed by these events. The resulting experiences of helplessness and depersonalization can be especially overwhelming for the patient whose psychological integrity before the acute illness was insecure.

LONG-TERM REHABILITATION

The expectation is that early intervention and appropriate care, together with sensitive, intelligent management, will see the patient and his family through the trauma and stress of the acute cardiac episode. Long-term adaptation then becomes the focus of concern for the cardiac rehabilitation team. From the standpoint of coping or defensive adjustments, the most prevalent mechanisms encountered during early recovery, and throughout long-term rehabilitation, are depressive reactions and denial of illness. For this reason a rather specific and detailed account of these two mechanisms as encountered with cardiac patients is in order. It is most common that these reactions and anxiety are the predominant ones which the rehabilitation counselor observes and with which the counselor will have to deal in working with cardiac referrals.

Depressive Reactions

It takes only a minimum of experience to recognize and appreciate the symptoms of depression. This is a prominent response in most, if not all, chronic illnesses and an understanding of the reasons behind depressive reactions is important for effective cardiac rehabilitation.

Certain important factors contributing to depressive reactions in the cardiac patient have been investigated and reported. One significant finding is that the severity of cardiac disease is apparently unrelated to the occurrence of depressive reactions. However, depressions among patients with more severe cardiac disease appear to persist longer, perhaps for years. In addition, it has been found that more frequent hospitalizations for recurrent problems generate more severe, longer lasting depressive reactions in cardiac patients. This is most clearly attributable to the stress and anxiety inherent in hospitali-

zation. Even though a clear necessity for the most part, admission to the hospital may create more problems for the patient than it solves.

Basically, depressive reactions occur in patients with heart disease for the same reasons as for everyone else. Depression is an expression of feelings of helplessness and hopelessness, and is evidence that the individual's means of coping with the situation are inadequate. The depressed cardiac patient is revealing that all of his usual methods of dealing with problems and stress simply are not working. Depression is thus a "back-to-the-wall" situation which may require intervention.

Depressive reactions, in cardiac patients at least, appear to be somewhat related to their degree of somatic preoccupation or hypochondriasis. During the acute stage of an illness, increased sensitivity and attention is naturally focused on bodily sensations and the physical state. However, evidence from numerous studies shows clearly that this somatic preoccupation can persist and become exaggerated over the few months following the acute cardiac event. This has been found to be detrimental to rehabilitation efforts and optimal patient cooperation in the treatment regimen if it persists past the acute recovery stage. The more extreme the person's somatic preoccupation in terms of excessive bodily concern and focusing on physical symptoms and sensations, the more restricted will be his range of activities and relations, and the poorer the prognosis for rehabilitation. These responses have also been linked to higher mortality and more complications during the early months following the acute cardiac episode, and to poorer post-surgical adjustment and rehabilitation.

Denial of Illness

Most rehabilitation workers find it subjectively easier to accept the appearance of depressive reactions and increased somatic preoccupation in their clients than to deal with the equally prevalent defensive mechanism of denial. Most of us react to expressions of denial by our patients as reflecting unrealistic expectations and lack of understanding or adaptation to the limitations of their disease and disability. On the contrary, it is well established that denial is an effective defense which is remarkably efficient as a buffer against the psychophysiological effects of stress. This appears to also be true for myocardial infarction patients in the CCU because severe depression reactions and the inability to use denial during acute illness has been related to early death among CCU patients. The point of these findings is that denial during the acute recovery stages of cardiac disease is an effective and desirable means of adaptation. However, although evidence is lacking in this regard, the same mechanisms lose their value and are counterproductive in terms of long-term rehabilitation objectives. It is currently not possible to make any sweeping generalizations concerning this latter point, especially in view of the several degrees and variations that denial of illness may take.

Several forms of denial of illness have been identified, any one of which may be observed in the post-infarction and the post-surgical cardiac client. Four major expressions of denial are:

1. Complete denial in which the patient will deny being ill or disabled in any respect.
2. Denial of major symptoms of incapacities while less threatening aspects of illness are stressed.
3. Minimization of incapacities or disability with expressions that symptoms are benign.
4. Temporal displacement in which patients admit past illness, but deny present incapacities.

Recently, psychiatric investigations have taken a more positive view of denial in acute myocardial infarction patients. Denial is currently seen as the principal coping mechanism by which acute MI patients deal with the stress of their illness. In addition, denial effectively reduces anxiety, diminishes emotional stress and the physiological responses to stress. In fact, the ability to use denial

successfully is associated with better survival in the myocardial infarction patient.

Family Reactions to Stress of Illness

Frequently the stress responses, attitudes, and emotional reactions of the family members represent a formidable problem in rehabilitation planning. The rehabilitation counselor must be prepared to work with the family relationships and attitudes in order to be effective in rehabilitating the cardiac patient.

Family attitudes and relationships are recognized by virtually all rehabilitation workers as having a vital and significant impact upon treatment outcomes and successful adjustment to disability. Role and relationship changes, family response to anxiety and financial stress are the most critical problems in terms of the MI patient and family members.

Often, there is also a considerable discrepancy between the patient's views of the family's problems and the views of the other family members. These issues must be resolved just as the patient's psychological and emotional adjustment is directly approached in rehabilitation.

One major issue involving the family is the curtailment of activities which often results from the physical and economic setbacks of an illness. Fear of recurrent heart attack often leads to giving up former recreational activities and also has a definite impact upon sexual behavior of the patient and spouse. Lack of vocational and economic security invariably creates tension between family members, further aggravating the patient's lack of self-esteem. There is general agreement among rehabilitation workers that the most expedient and direct means of intervention must be taken as early as possible to assist the family in regaining former patterns of relationships and activities. Without this source of support, security, and reassurance both treatment progress and rehabilitation outcome will definitely be impeded, perhaps even defeated.

There is little doubt that emotional factors play a crucial role in the entire area of heart disease. The appraisal and management of the cardiac patient, both during acute recovery and in long-term rehabilitation, must in large measure deal with the psychological aspects of the illness and the patient's and family's reactions to the disease and its treatment.

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EVALUATION OF DISABILITY IN CARDIAC DISEASE

BASIC REQUIRED MEDICAL DATA

Before full understanding of the client can be achieved the counselor must have certain medical information. This includes a complete medical history: the diagnosis, complications, medication, whether the illness is stable or unstable, and any surgical procedures. A careful physical examination covering the heart, lungs and peripheral vessels including both arteries and veins must be recorded. An interpretation of a recent electrocardiogram is necessary, as is a chest x-ray. The electrocardiogram can indicate abnormalities of heart rhythm as well as evidence of heart damage, drug effects, or inadequate oxygen supply to a portion of the heart. The chest x-ray can show evidence of pulmonary vascular congestion, dilatation and/or hypertrophy of the heart and any of its chambers.

Finally, it is necessary for the counselor to have an opinion regarding the client's functional capacity. A helpful clinical guide was devised by the New York Heart Association and has been in use for many years, Table 2.

FUNCTIONAL CLASS

I No limitation. No symptoms with ordinary activity.

II Slight limitation. Comfortable at rest. Symptoms with ordinary activity.

III Marked limitation. Comfortable at rest. Symptoms with less than ordinary activity.

IV Symptoms with any physical activity. May have symptoms at rest.

Table 2. The functional classification of clients with heart disease. Ordinary activity refers to activity that is customary for the client, not the counselor.

A simpler but less widely used classification is shown in Table 3. These classifications apply only to individuals with documented heart disease. The functional capacity assessment is made in the terms of

the client's experience, not in terms of the customary activity level of the person making the assessment whether that be the counselor, a nurse, or physician. It is, of course, best to have some objective information regarding a person's functional capacity which may be obtained from a stress test, but in the absence of either the results of the stress test or the ability to perform one, then at least a subjective assessment should be made.

STATUS

I. Uncompromised
II. Slightly compromised
III. Moderately compromised
IV. Severely compromised

Table 3. Revised functional status classification of clients with cardiac disease. This classification is simple, and is more subjective than the earlier, more widely used classification.

ADDITIONAL MEDICAL PROCEDURES

STRESS EVALUATION

The exercise stress test is an invaluable and virtually necessary tool if truly comprehensive activity counseling for work, play and reconditioning is to be accomplished. The counselor needs the information obtained from the stress test to properly deal with the client and his/her place in the world of work. The exercise test should be requested whenever a major job change is anticipated and before returning to work after an acute cardiac illness. An exercise stress test can be performed utilizing the Master step test, a bicycle ergometer, or more commonly, the motor driven treadmill. Major indications for an exercise evaluation include:

To evaluate chest pain: is it from cardiac or non-cardiac sources?

To evaluate functional capacity: this is most important from the counselor's point of view.

To assess therapy, either medical or surgical.

To provide clearance, motivation and justification for therapeutic exercise.

To individualize an activity prescription.

To follow the natural history of a condition, predict risk and improve an assessment of prognosis.

To demonstrate the level of exercise capability to an anxious or fearful client.

There are times when the test should not be performed. The contraindications are usually obvious. The proper, safe timing of the evaluation will be determined by the physician.

With careful evaluation to rule out contraindications, an exercise test can be performed safely on patients with heart disease and a catastrophe in the exercise laboratory is rare. The use of medical personnel who are fully trained and equipped to handle any emergency contributes to the safety of the procedure.

Many exercise protocols have been devised and most have real value. Those which begin at low energy cost are best for initial studies in patients with ACHD. As exercise progresses, the work load becomes increasingly strenuous. Heart rate, blood pressure, the electrocardiogram and the patient's clinical condition are continuously observed and are recorded each minute. In sophisticated laboratories, the oxygen consumed at each stage is measured directly; usually it is estimated from tables. The evaluation may be stopped whenever symptoms appear, the blood pressure becomes too high or falls, arrhythmias appear, the patient is tired, or at a previously determined heart rate (Table 4).

TARGET HEART RATES

Age	60%	70%	85%	90%	100%
25	120	140	170	180	200
30	116	136	165	175	194
35	113	132	160	169	188
40	109	128	155	164	182
45	106	124	150	158	176
50	103	119	145	154	171
55	100	115	140	149	165
60	96	111	135	143	159
65	92	107	130	138	153

Table 4. Target heart rates with exercise. Note the decrease in maximum heart rate capability with advancing age.

Often, the heart rate is used as an end-point for exercise studies. As can be seen from the table above, maximum heart rate decreases with advancing age.

The most important heart rate to observe is the highest rate achieved without an abnormal response, the clearance heart rate. This is the highest heart rate that was safely reached, that is, without angina, without electrocardiographic abnormalities and with a safe blood pressure. Once the clearance heart rate is determined an exercise prescription is written and activity counseling is given. The procedure is simple: determine the clearance heart rate, take 85 percent of this rate (this provides a 15 percent safety margin), find the METS at which the 85 percent of clearance heart rate occurred, consult the listing of occupational and recreational activities and advise the client appropriately. You may want to prepare a handout of acceptable activities which can be given to the client once you have determined the appropriate advice.

A discussion of METS and the energy cost of activities is found on pages 59 and 60.

The procedure for determining rational exercise, work, or recreational counseling is fairly simple and straightforward. There are, however, limitations in transferring data from the exercise lab into the "real world." Keep these items in mind when reviewing exercise data for counseling purposes. You may need to modify an initial impression.

Emotional Stresses

Does the client dislike the job or activity? Does he get along with colleagues? Are disabled clients treated well by employers and fellow workers? Is there a high level of job pressure? Is the work environment pleasant? Are there many deadlines to be met?

Work Environment

Temperature — Extremes of both heat and cold are cardiovascular stresses and should be minimized or avoided.

Air quality — Carbon monoxide content is of special concern. Carbon monoxide decreases the amount of oxygen available and decreases the ability of hemoglobin to release the oxygen bound to it.

Inclines to be negotiated — For example, ladders, ramps, steps.

Amount of isometric stress — Isometric or static stress is a potent way to increase myocardial oxygen demand. Isometric activities should be minimized. The counselor needs to know details of tasks required to perform a specific job so that isometric components can be decreased or eliminated. A visit to the job site can be very helpful here.

Personality

The client with an aggressive attacking type of personality may expend more energy than the average person to accomplish a task. In this instance, the activity prescription should be reduced or the client trained to modify his approach to work. This is another area where a visit to the job site can be valuable.

HOLTER MONITOR

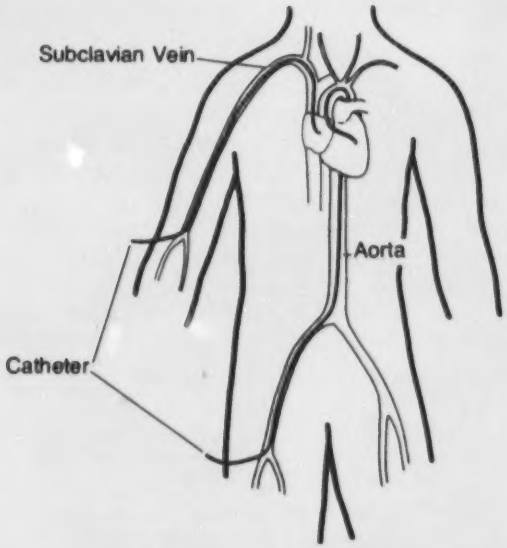
For those in whom an abnormality of heart rhythm is suspected, a continuous electrocardiographic monitoring on magnetic tape (Holter monitor) during normal job activities is often very helpful. Not only does it permit evaluation of arrhythmias but one can understand and observe the heart rate response to specific vocational tasks and situations, an item that is of great importance to the counselor. In this way an objective evaluation can be obtained under actual working conditions. The device that the client carries is small (less than 2½ lbs.) and unobtrusive. Some athletes have worn this while running a mountain marathon and not felt that it hindered their performance. It can certainly be worn by clients in a job evaluation study.

CARDIAC CATHETERIZATION

At the present time, cardiac catheterization provides the most definitive "hard" information about anatomy, cardiac output, pressures within the heart chambers and vessels, and functional capacity of the chambers. Many clients with heart disease will have had a heart

catheterization as part of data gathering in order to improve assessment of prognosis, form of therapy (medical or surgical) and to define the anatomy a surgeon will encounter should this approach be taken.

Cardiac catheterization is performed in a specially equipped laboratory under sterile conditions. Either arteries or veins may be catheterized; often both are required to obtain complete information. The approach is either from the arm at the bend of the elbow, or leg in the groin. The catheters are small in diameter, about two millimeters, and are inserted into the vessel through a small incision in the skin or through a skin puncture. The catheter is then threaded up the vessel and into the heart. It passes the heart valves quite easily, permitting blood samples and pressures to be recorded from all chambers of the heart. In addition, contrast material can be injected into any of the chambers or vessels while black and white moving pictures are taken and their anatomy and function assessed. Coronary cineangiography, the selective injection of contrast material into the coronary arteries, is the current "gold standard" in the evaluation of the extent and anatomic severity of obstructive coronary artery disease. Coronary angiography is the most widely performed catheterization procedure.



Clients who undergo cardiac catheterization will be admitted to a hospital with a suitable catheterization laboratory. Total hospitalization rarely exceeds one or two nights. The procedure is done under local anesthetic with mild sedation given prior to leaving the floor for the laboratory. Sensations experienced by the client may include: a burning sensation as the local anesthetic is injected into the skin, a "tickling" sensation in the arm as the catheter passes up the vein on the inner aspect of the arm, palpatations and light-headedness from extra beats caused by the catheter touching the myocardium, flushing and a feeling of warmth immediately following an injection of contrast material, and angina pectoris if there is enough stress. There is no pain associated with the catheter touching the heart muscle.

Following the catheterization, there will be some local soreness and discoloration (like a bruise) at the site of entry through the skin. Any stitches used to close the skin are removed after one week. A small scar about one inch long will remain.

The risk involved in cardiac catheterization is very low and generally the information obtained at catheterization is of sufficient importance to justify the slight risk. However, the risk increases with increasing severity and complications of the basic disease.

OTHER STUDIES

Other studies which may appear on the client's records from the attending physician or his consultant may include an echocardiogram (ultrasound study of the heart), phonocardiogram (graphic recording of heart sounds), apexcardiogram (graphic recording of chest wall movements caused by heart activity), vectorcardiogram (a specialized recording of the electrical activity of the heart) or isotope studies. Of these special procedures the most likely to be encountered are the echocardiogram, vectorcardiogram and, increasingly, isotope studies. Isotopes may be used to identify areas of myocardial ischemia and to determine aspects of the heart's ability to work as a pump. The technology required to perform these studies well is sufficiently complex, as are the applications of the procedures, so as to make a detailed review impractical. The counselor should, however, be aware of their availability and potential value.

CARDIAC REFERRAL FORM FOR COUNSELORS

The counselor must have the same basic information available for

vocational counseling as is required by the physician for a reconditioning prescription. In order to help the counselor obtain this information, a Cardiac Referral Form was developed by the authors of the handbook and has been revised after use and review. The Cardiac Referral Form has the advantages of brevity, little time being required to complete it, and in providing a tool that the counselor can use in the client's behalf. Most of the medical information required by the counselor for patients with cardiovascular disease is requested on this form. At the present time, not all physicians understand some of the concepts and techniques required to follow the approach outlined in this handbook and distilled in the Cardiac Referral Form. The counselor can therefore become instrumental in assisting in the upgrading of medical care by introducing these principles to the medical consultant or referring physician. References are available to the consultants should additional reading be desired.

INFORMATION FOR VOCATIONAL PLANNING

CARDIAC REFERRALS

Patient's Name _____

Date of Exam _____

I. Cardiovascular Data
   a) Specific diagnosis and dates of clinical events
   b) Pertinent history
   c) Physical findings & reports
      (BP, HR, EKG, other lab)
   d) Medications
   e) Prognosis

II. Functional Capacity
   a) Stress test results (if performed)
      Max HR & BP achieved
      % Estimated maximum HR achieved
      METS
      Arrhythmias
      Symptoms
      Reason for stopping
   b) Clearance MET level
      (METS @ 85% of maximum tolerated or safe HR)

c) Exercise prescription given
d) Functional Classification

III. Problem Areas Seen in Relation to Vocational Planning
a) Personality
b) Psychosocial
c) Physical

IV. Vocational Recommendations
(Specific limitation, i.e. — weight limits, hours, specific roles or tasks to be avoided, work environment, etc.)

Date of release for work:

V. Comments:

_____

(Signature) (Date)

Telephone No. _____

VOCATIONAL EVALUATION

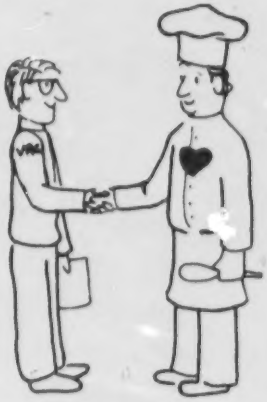
Vocational evaluation of the cardiac client does not differ significantly from the vocational evaluation of clients with other disabilities. The principles of evaluation are well known and will be mentioned only briefly.

CLIENT-COUNSELOR INTERACTION

The quality of the client-counselor relationship is fundamental to the success of any rehabilitation effort. The cardiac rehabilitation program must be flexible so that it can incorporate and build on the individual factors identified through client-counselor communication. The relationship between the client and counselor must be relaxed, straightforward and comfortable so that a free exchange of information and feelings can occur. The client must feel free to closely examine the personal assets and liabilities that must be identified, considered and impact assessed. Furthermore, the client must be handled in such a way that he becomes an active participant in the

development of the rehabilitation plan, and the counselor must be able to create an atmosphere that will facilitate realistic evaluation and decision-making.

Clients will often need assistance in assessing disability in relationship to their employment, temporary family disorganization, and the reservations that accompany reentry into the labor market. The counselor must often take the lead in surfacing these concerns — just because the client fails to bring them up does not mean that they are not a significant potential or real barrier to successful vocational rehabilitation. An open, relaxed, professional association between the client and counselor will be a great help in achieving the desired outcome for the client.



MEDICAL EVALUATION

All cardiac clients must, of course, be examined medically to determine cardiac functional capacity so that correct activity counseling can be given. Medical evaluation is a necessary part of the vocational assessment and determines if the client is ready for employment, and what restrictions on activity and environment should be imposed. Should the client not be ready for work, the data will furnish some indication of the future prospects and what will be required medically to restore him to employability. Details of the medical evaluation, particularly the value of the stress evaluation, are discussed in the section on medical evaluation of disability. Following the medical evaluation the physician should be asked for the information requested on the vocational referral form, pp. 48-49. The counselor will then have the necessary information to assist the client with rational, safe vocational decisions.

JOB READINESS

The utilization of transitional employment and vocational evaluation for cardiac clients may at times be advisable. First, there may be the need for testing under working conditions for those with doubtful work capacity. Secondly, the evaluation of the cardiac client who has superimposed, extra medical problems, either emotional or environmental, may be useful. The rehabilitation counselor can evaluate the impact of both categories and provide for services that will restore satisfactory work capacity. If the client complains to the counselor of symptoms related to the underlying heart disease, these should be reported to the attending physician. Some patients do not want to let their physicians down by not doing well during convalescence and return to activities and may not report important symptoms. The counselor may be the one to whom the client gives important medical information.

VOCATIONAL HISTORY

Considerable weight in vocational assessment must be given to the person's work history. If the client were employed, will his former job still be physically safe; if not, what elements can be applied toward other jobs? Can the job be modified? What skills are intact from previous jobs that might be recalled, should a change in vocation be necessary?

Knowledge of the client's work habits is as important as his physical capacity. Is the client a perfectionist? Does he work at an even pace? Is he upset by mistakes or delays? How does he organize his work? The level of non-physical job stress can be assessed by understanding the client's approach and attitude toward job activities.

Past performance is one of the best indications of future vocational behavior. A history of repeated firings or absenteeism will most likely be repeated in the future.

Another critical factor is the level of job satisfaction that the individual had before the cardiac problem. Return to work in a job which offered limited satisfactions may not be an attractive prospect.

PERSONAL AND FAMILY HISTORY

All aspects of daily living of the cardiac client must be considered, including avocational interests, type and regularity of exercise, smoking and use of alcohol. In addition, it is important to understand relationships among family members and the roles played by each.

Rehabilitation plans and programs usually need the cooperation and support of important family members to succeed, and family counseling must often be undertaken as part of the process.

FINANCIAL BACKGROUND

A clear understanding of the client's financial status is imperative. Nothing makes a client feel more helpless during rehabilitation than the threat imposed by the expenses generated by the illness. The resources of the client as well as those available within the community must be assessed and utilized if needed.

PSYCHOLOGICAL EVALUATION

Problems of a persistent and sometimes exaggerated nature are often encountered during recovery and rehabilitation from life-threatening illness. Problem areas or potential adjustment difficulties should be identified early in rehabilitation planning, and evaluations made in order to plan intervention strategies accordingly. Often, the best psychosocial evaluation is not a battery of standardized psychologic tests but is rather the repeated contact with a member of the rehabilitation team who understands the nature of the illness and the usual emotional responses to acute and chronic forms of the illness. Psychologic tests evaluate the emotional status of the client at the time the test was taken and therefore do not reflect the often rapidly changing emotional climate of a convalescent.

APTITUDE TESTING

Cardiac patients occasionally complain of changes in memory, motor coordination and attention span. These complaints or concerns should be followed up with appropriate evaluation. Cognitive, perceptual and coordination deficits do occur with cardiac disease. Standardized aptitude or ability testing may be of little value, however, since their validity for use with the handicapped population has been seriously questioned.

The vocational rehabilitation counselor must clearly have a broad understanding of each client's medical, psychosocial and, vocational problems and must be equipped either to evaluate them or to refer the client to other resources for evaluation and management. The counselor should, as necessary, act as a "go-between" for the client and other members of the rehabilitation team. The counselor must be a competent, compassionate and interested observer in order to perform well on behalf of the cardiac client.

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REHABILITATION IN CARDIAC DISEASE

This section is designed to give the counselor insight into a cardiac rehabilitation program and the principles on which it is based. It is important that the counselor have an appreciation of what the client has experienced, his knowledge, and his expectations. Ideally, the counselor is an integral part of the rehabilitation process. Early in the recovery from an acute event the counselor can have an important positive impact on the client's attitudes and his approach to returning to work. Unfortunately, many communities do not yet have an organized, coordinated multi-disciplinary program in cardiac rehabilitation. The current trend, however, is to develop some form of rehabilitation program, usually based in the community hospital utilizing those disciplines available in the institution and community. The vocational rehabilitation counselor should be one of the resources included in the rehabilitation effort. It is hoped that the counselor will recognize the value of cardiac rehabilitation and help initiate and support a program if none exists.

PRINCIPLES OF CARDIAC REHABILITATION

THE NEED FOR CARDIAC REHABILITATION

If the average coronary care unit mortality from acute myocardial infarction (AMI) is 20%, then up to 80% of patients with AMI in the employable age group (age may vary from one community to another) are candidates for post-MI rehabilitation, including vocational assessment and counseling.

All patients with angina pectoris sufficient to create a vocational handicap are candidates for some or all phases of the rehabilitation program. They have much the same natural history, psychosocial and vocational problems as does the heart attack client. Post-saphenous vein bypass patients have been largely neglected as far as rehabilitation is concerned. Too often the client feels that once surgery has been performed, the disease has been cured. Although surgery is usually successful in relieving angina pectoris, it does not prevent the progression of atherosclerosis. A single technical event in the natural history of a dynamic disease cannot be considered comprehensive rehabilita-

tion care. Basically, all patients with coronary atherosclerotic heart disease are candidates for comprehensive care.

There is a tremendous unmet need for cardiac rehabilitation that applies to all sources of patient/client care: from rural community to major teaching and research hospitals.

DEFINITION

A concise yet comprehensive definition of cardiac rehabilitation is that of Dr. John Naughton:

> "The process of restoring and maintaining a patient at his optimal physiologic, psychologic, vocational and social status."

If a rehabilitation program meets the demands of this definition, then a total care program is dictated — one that begins at the onset of the illness and extends indefinitely. It can be justifiably said that rehabilitation is total, comprehensive care.

COMPREHENSIVE CARE

Some of the major requirements of a comprehensive care program, of which the counselor must be an integral part, are listed.

Longitudinal

Comprehensive care should be open-ended because most heart disease is dynamic and progressive. Disability can therefore change or appear at any time. Rehabilitation does not end with discharge from hospital, on return to work or on resolution of a medical or psychosocial problem — it extends for the remainder of the client's life. In addition, periodic client contact often permits detection of disability at an earlier stage than if the client were not seen on a regular basis. In many offices and agencies, cases are closed when specific guidelines are met. This should not prevent the counselor from at least telephoning the client every six months to assess current status and demonstrate continuing interest in the client.

Individualized

Each client, family and community is different in some way: responses to disability or acute illness, expectations regarding activity, attitudes toward being hired or hiring the disabled, etc. These attitudes must be uncovered and dealt with in ways that are most apt to modify behavior, change attitudes, ensure and enhance vocational viability.

Disability Conscious

Each staff person who encounters the client must have a basic understanding of all varieties of disability in cardiovascular disease and be able to manage those problems which lie within one's area of expertise. In addition, each person should help arrange the appropriate referral or consultation for problems outside of one's field of expertise. For review, the major sources of disability are listed below.

Physiologic: pump failure
- symptoms of pulmonary vascular congestion
- symptoms of low cardiac output

pain

arrhythmias that are symptomatic

Psychosocial

Vocational

Participatory

In most cardiovascular disorders, and especially in atherosclerotic coronary heart disease, there will be little, if any, modification of natural history or attainment of the goals of comprehensive care if the patient/client does not follow advice, modify behavior and risk factors, take medication on time, keep appointments, etc. The client, family, and often the employer must become involved in the comprehensive care program.

Optimum & Maintenance Oriented

It is usually fairly easy to restore the client to the pre-acute event status. In the case of coronary disease risk factors, doing nothing is all that is required to restore the client to the pre-event s[illegible]. Vocationally, most clients who return to work will return to [illegible]e same job following heart attack whether enrolled in a compre[illegible]n-sive care program or not. However, approximately one-third will require some modification of the job tasks or work environment. If the need for these changes is not identified and appropriate action taken, the client may be forced to quit work. A key to comprehensive care is that all potential sources of disability must be sought, problems identified, the specific situation optimized and then maintained at the optimal level indefinitely. Again, the effort must be longitudinal.

Preventive

One of the ultimate tests of a comprehensive care program is its

ability, or lack of it, to prevent an initial manifestation of the disease or disability (primary prevention), or if the disease is clinically evident, to prevent additional acute episodes (secondary prevention). In contacts with clients, the counselor is primarily working in the area of secondary prevention. It should be understood that primary and secondary prevention apply to all sources of disability for a particular illness. For example, if the client has lost a job as the result of a heart attack but has been rehabilitated and placed in another position, it is the counselor's mandate to do all that is necessary to try to prevent a recurrence of the job loss (secondary prevention).

GOALS OF CARDIAC REHABILITATION

Any program is judged on its ability to achieve identified goals. The following goals of a cardiac rehabilitation program are simple and generally attainable. The counselor will have particular impact on those areas which improve the quality of the client's life. Extending life is primarily a medical issue.

Improving Quality of Life

Work — Maintain vocational viability if at all possible.

Educate — Make sure the client, family, employer and any others with a need to know understand the nature of the illness, indications of change in health status, medications, appropriate activity limits, risk factors, etc. A well-educated client, as well as others who affect his daily life, is far more apt to actively participate in the comprehensive care program than one who does not understand the illness and is therefore anxious, frustrated and insecure.

Preserve psychosocial integrity — Most acute cardiac episodes are crisis events, threatening virtually all aspects of a client's life. One wonders why there isn't more psychosocial disability than is currently recognized. Everyone should be on the lookout for existing problems as well as potential sources of problems for early identification and intervention when necessary.

Extend Life — Improve Its Quantity

This is accomplished mainly through *risk factor identification* and *optimizing* medical and surgical treatment.

FUNDAMENTALS OF CARDIAC REHABILITATION

The following topics provide an information base which is necessary if one is to understand and apply comprehensive care principles. Each member of the rehabilitation team (identified later) contributes through the performance of specialized tasks. A general comprehension of all the material is necessary if one is to deal with clients in a manner consistent with that of other team members and if the activities of other members are to be understood. The same fundamentals apply whether there is an organized team or not.

HEALING OF MYOCARDIAL DAMAGE

Understanding how the heart heals after damage or heart attack forms a rational basis for planning the return to all forms of activity. The heart heals just as does damaged tissue elsewhere in the body, by scar formation. The stages of healing are:

Leucocytic (white blood cell) Infiltration

This stage includes the first seven to eight days after damage and coincides with the period of greatest weakness in the area of cell death. This is when myocardial rupture is most apt to occur and should be the time of least physical activity.

Removal of Dead Tissue

Begins on the third day and may take several weeks to complete.

Active Scar Formation

Begins the third week after damage. Low level activity is permitted (3-5 METS). All activities of daily living are easily handled and seated desk or light bench work is acceptable.

Scar Maturation

Toughening of the scar takes up to 12 weeks, depending on the size of the damaged area. Progressive increase in all activity may be prescribed during this time.

THE ENERGY COST OF ACTIVITIES

The usual way of quantifying the energy required to complete a task was to estimate calories burned. However, the tables of caloric expenditure for different activities are based on the energy cost of tasks for a 70 kg male (154 lbs). This, of course, prevents generalization of the information, since most individuals are neither 70 kg nor male.

Since the total oxygen consumed during performance of a task will increase with increasing body size, it has been useful to consider the energy cost of activities on the basis of oxygen (O_2) required per unit of body weight, the kilogram. The unit now commonly used to grade activities is the MET or metabolic equivalent. A MET is the amount of oxygen consumed per kilogram of body weight per minute. One MET is the amount of oxygen utilized at seated rest, approximately 3.5cc/kg/min.

Since METS are based on body weight, persons of all sizes can be given activity prescriptions that provide the same *relative* amount of energy for each.

Patients with heart disease are commonly classified according to their ability to perform tasks usual to their own customary activity level. A general correlation of METS with the New York Heart Association Functional Classification has been made (Table 5).

	FUNCTIONAL CLASS	METS	VO2 (cc/kg/min)
I.	NO LIMITATION, NO SYMPTOMS WITH ORDINARY ACTIVITY.	7 & >	24.5 & >
II.	SLIGHT LIMITATION. COMFORTABLE AT REST. SYMPTOMS WITH ORDINARY ACTIVITY.	5-6	17.5 - 21.0
III.	MARKED LIMITATION. COMFORTABLE AT REST. SYMPTOMS WITH LESS THAN ORDINARY ACTIVITY.	3-4	10.5 - 14.0
IV.	DISCOMFORT WITH ANY ACTIVITY. MAY HAVE SYMPTOMS AT REST.	1-2	3.5 - 7.0

Table 5. The correlation of Functional Classification, METS and Oxygen Consumption. Most vocations can be practiced by Class I clients, many by Class II and III, and a few sedentary jobs by Class IV clients.

TYPES OF MUSCULAR EXERCISE

METS apply to only aerobic activities or exercise, not to other forms of muscular activity. The major types of muscular exercise are aerobic, isotonic and isometric. Major characteristics of each and some examples are shown in Table 6.

TYPES OF EXERCISE	CHARACTERIZED BY	EXAMPLES
AEROBIC	↑ OXYGEN CONSUMPTION (VO_2)	Walk, Jog, Bicycle
ISOMETRIC	NO JOINT MOTION: EXERTION AGAINST FIXED RESISTANCE	Work With Arms Over Head. "Doorway" exercises. Carrying briefcase.
ISOTONIC	SAME MUSCLE TONE THROUGH A FULL RANGE OF JOINT MOTION	Chin up, sit up. Most bench work.

Table 6. Some major forms of muscular exercise. Actually, most activities contain elements of more than one form of exercise, but one type tends to dominate in terms of the response of the lungs and circulation.

Actually, all forms of exercise require the consumption of oxygen and therefore have an aerobic component. For our purposes, aerobic exercise is characterized by rhythmic activities which demand a substantial increase in oxygen consumed. Isotonic exercise is characterized by the same tone on a muscle as it is moved through a full range of joint motion. On the other hand, in isometric exercise there is muscular exertion but no joint motion; the activity is static in contrast to dynamic motion in aerobic exercise.

The classification is not actually complete. It does, however, help to sort out the major types of exercise encountered during daily activities. Aerobic exercise is the only form of exercise for which there is any

evidence of a protective effect for prevention of clinical events caused by ACHD, either primary or secondary.

Isometric exercise has a marked effect on blood pressure. The increase in blood pressure demands an increase in the force of contraction of the left ventricle resulting in an increase in myocardial oxygen demand. If the client has significant narrowing in one or more of the coronary arteries, the demand for increased oxygen supply brought about by isometric stress may not be met and angina pectoris may be produced.

The major cardiovascular responses to aerobic and isometric exercise are shown in Table 7.

	ISOMETRIC	AEROBIC
Heart rate	slight ↑	↑ to plateau
Blood pressure		
systolic	progressive ↑	↑ to plateau
diastolic	progressive ↑	remains the same or ↓
Oxygen consumption	slight ↑ or no change	↑ to plateau

Table 7. A comparison of the major cardiopulmonary adaptations to isometric and aerobic exercise.

Some additional points about isometric exercise are worth remembering and are presented below.

The blood pressure response to isometric exercise will be added to that of aerobic stress. For example, if one is walking briskly, the systolic blood pressure will rise and the diastolic pressure will remain the same or fall slightly. If a heavy briefcase or suitcase is placed in the subject's hand, forearm isometric exercise will be required to keep from losing grip on the handle, and diastolic pressure will begin to rise.

A large muscle mass is not required to produce the typical increased blood pressure response to isometric exercise. The rise in pressure will be just as pronounced with 30% maximum forearm isometric stress as with 30% maximum thigh muscle isometric stress.

The blood pressure response occurs rapidly (within a minute) and is relieved almost immediately upon release of the isometric stimulus.

Isometric activities in work situations should be minimized, if possi-

ble. Very brief isometric tasks are permissable, such as carrying a box for a short distance, requiring less than one minute of isometric activity.

Working with the arms overhead is a common form of isometric activity involving the muscles around the shoulder. It is not uncommon for clients to develop angina pectoris with this kind of activity — an observation that has led many physicians to counsel their patients to not work with the arms. This is an unreasonable position to take. Many people require arm activity to perform their work. It is better to review the specific job in detail and make whatever modifications are necessary to keep arm work rhythmic (and therefore aerobic) rather than static (isometric).

The physiologic response to isotonic exercise is related to the weight being moved. For example, lifting items of low weight frequently and without carrying them (low weight; high repetitions) produces an aerobic-type cardiovascular response. On the other hand, high weight, near one's maximum capability, causes a response more like isometric than aerobic stress. Again, the individual job situation must be assessed and, if necessary, modified.

THE REHABILITATION TEAM

Any person who can have a positive effect on the client's ultimate outcome belongs on the cardiac rehabilitation team. Communities, clinics and institutions may vary in the number of disciplines available to a rehabilitation program. It is not necessary to have all potentially beneficial specialities represented — enlist whomever you can, as any coordinated effort is better than none at all.

The following list includes the usual rehabilitation team members and some of the roles each might play in the comprehensive care program.

Physician

Generally a client referral must come from the client's physician or physician working with the rehabilitation team. It is therefore mandatory to secure the *active* support and participation of a physician knowledgeable in the problems of clients with cardiovascular disease if a program is to survive and thrive. The physician prescribes patient care, medications, and exercise. In addition, the M.D. should provide training and program leadership.

Vocational Rehabilitation Counselor

The VRC should become involved as soon as a question of vocational viability is raised. It is often helpful to obtain a vocation history during recovery from an acute event, even during hospitalization. Although the client may not require a job change, the contact will help to generate and support a sense of continued ability to work and can facilitate a follow-up interview and visit to the job site once the client has returned to work. A contact with the client's employer during the first month after onset of an acute illness will help to assure that the client's job has not been given to another employee. In addition, the contact can be used to remind the employer of the usual good functional status of his employee after healing is complete. The counselor can assess the vocational situation and discuss necessary modifications with the client and employer. In this sense, one of the counselor's loftiest and most important tasks is fulfilled: client advocate.

Nurse

One or more nurses should be involved in any comprehensive care program. Roles the nurse may play include: program coordinator, clinician, patient and family educator, technician, and exercise leader.

Physical Therapist

Physical therapists are becoming increasingly interested in cardiac rehabilitation and can make a very worthwhile contribution. The PT may be involved in progressive ambulation of the client in hospital, reconditioning the client as an out-patient, identifying and modifying physical limitations to full activity and client/family education.

Occupational Therapist

The occupational therapist and physical therapist can, and should, work closely together during all phases of the rehabilitation program. Their tasks are to translate activity prescriptions into practical, safe activities at home, on the job and during reconditioning. Special contributions of the OT include assisting the patient with a rational, progressive return to performing activities of daily living, and training the client in work simplification techniques at home and on the job.

Nutritionist

The nutritionist counsels the client and the family cook regarding special diets for control of body weight, high blood fats and carbohydrate intolerance (diabetes or near-diabetes).

Psychologist/Psychiatrist

The psychologist or psychiatrist is helpful in behavior modification, stress management, evaluation and therapy of excessively debilitating or prolonged abnormal emotional responses to an illness. He assists the rehabilitation team in understanding motivational, attitudinal and behavioral aspects of the patient and family.

Medical Social Worker

The social worker is an excellent person for family crisis intervention and may be instrumental in keeping families together during an illness when crises may threaten even the strongest unions. Some of the areas in which the social worker can be most helpful are role reversal, financial concerns and understanding responses of others to the illness. Generally, a pragmatic, non-analytic approach is most efficient.

Exercise Physiologist

With the increasing numbers of supervised out-patient reconditioning programs, the exercise physiologist, trained in principles of exercise for cardiac patients, has assumed an important and expanding role. The "new" physical educator could well provide program development, client education and exercise leadership for cardiac clients.

Patient/Client

Never forget this person. The client is an active participant in developing a sound, individually tailored rehabilitation plan. The client must never be permitted to become nothing more than a passive recipient of the thinking and planning of others. If the activities of any team member fail to be client-oriented and to have a direct, positive impact on the client, that person and/or approach should be discarded and replacements found.

PATIENT AND FAMILY TEACHING

A well-educated client and family are a real asset to all rehabilitation team members. An understanding of the illness, its complications, natural history, medications and other necessary interventions will produce a client who is much more receptive to suggestions for change. Each member of the team must be able to respond to most questions posed by the client and family — and to do so in a manner that is complete, compassionate and consistent with what others will say when asked the same question. Remember, whenever the client asks a question, it probably reflects a concern or anxiety and therefore should be answered without delay. Capitalize on the moment and do the necessary teaching if you possibly can. It is an opportunity to have a positive impact and perhaps to generate at least support a change in behavior. The information contained in this handbook should help you to provide acceptable and accurate answers to most of the topics listed on the following patient teaching outline. This outline represents the basic information that should be given to both patient and family — in as much or as little detail as can comfortably be assimilated. The teaching portion of the rehabilitation program should begin as soon as a clear diagnosis of coronary disease is made and should be continually reinforced and upgraded. Client education, as other aspects of the comprehensive care program, is an ongoing, open-ended process.

Most of the training will be accomplished by other members of the rehabilitation team. However, the counselor should be prepared to respond to the client's questions and should know what has been told the client by others so that teaching can be consistent. An annotated copy of the teaching outline would be a helpful part of the counselor's record.

CORONARY ATHEROSCLEROTIC HEART DISEASE TEACHING OUTLINE

	Dates of: Init. Disc.	Dates of: Rein-force-ment	Comments
I. GENERAL MEDICAL INFORMATION			
A. The coronary atherosclerotic heart disease process			
B. The acute clinical event -myocardial infarction - angina pectoris -coronary artery bypass surgery			
C. Related anatomy & physiology to help understanding of how the heart functions in health and disease			
D. The healing process			
E. Patient's & family's concept and reaction			
II. REHABILITATION OVERVIEW			
A. Definition			
B. Goals - comfortable, independent convalescent by hospital discharge - quality of life - quantity of life			
C. Rehabilitation team			
D. Duration of hospitalization			
E. Activity progression in hospital			
F. Activity modification			
G. Post-hospital rehabilitation			
H. Outlook for continued employment			

	Dates of: Init. Disc.	Rein-force-ment	Comments
III. PSYCHOSOCIAL ASPECTS			
A. Reactions to acute event - intervention to assist with coping			
B. Financial considerations			
C. Family adjustments			
D. Individual problems, needs			
IV. RISK FACTOR IDENTIFICATION & MODIFICATION			
A. Age, sex, heredity			
B. Smoking			
C. Hypertenfion			
D. Obesity			
E. Blood fats			
F. Diet			
G. Physical inactivity			
H. Personality/behavior			
I. Diabetes			
J. List patient's risk factors			
K. Specific recommendations			
V. DIET			
A. Cholesterol/saturated fats			
B. Triglycerides (carbohydrates and sugars)			
C. Calories			
D. Sodium			
E. Caffeine			
F. Alcohol			
VI. MEDICATIONS			
A. List patient's medications - for each give:			

	Dates of: Init. Disc.	Dates of: Reinforcement	Comments
name, dose, schedule, action & purpose, side effects			
B. Nitroglycerin - discuss how, when to use - action and side effects			
VII. ACTIVITY GUIDELINES			
A. Plan for return to activities			
B. Pulse taking and heart rate response			
C. Pacing activities			
D. Work simplification			
E. What to avoid			
F. Exercise - theory and benefits - types of exercise - warm-up exercise - individual prescription			
G. Specific Activities - driving - altitude - sex - hobbies - chores - other			
VIII. SPECIAL INFORMATION			
A. Warning symptoms			
B. Emergency care			
C. Follow-up appointment			
D. Community resources			
IX. VOCATIONAL ASPECTS			
A. Return to work			
B. Employer/employee relationships			

	Dates of: Init. Disc.	Reinforcement	Comments
C. Work modifications			
D. Special considerations			
X. LONG-TERM MANAGEMENT			
A. Prevention of another clinical event; improvement of pre-event status			
B. Causes of disability - angina - pump failure - arrhythmias - psychosocial			
C. Diagnostic procedures			
D. Medical management			
E. Surgical management			

IN-HOSPITAL REHABILITATION

More and more hospitals are starting programs of cardiac rehabilitation for their hospitalized patients. This section provides some insight into an in-patient program so that the counselor will have a basic understanding of this phase of rehabilitative care. This is especially important if the counselor becomes involved with the client during the acute phase of the illness (a desirable but not universal practice).

Rehabilitation begins on admission to the hospital with contact between the patient and a member of the health care team. This is usually a nurse or physician. The VR counselor may be involved early during hospitalization — a positive step at a time in the illness that threatens work as well as many other aspects of life.

DURATION IN HOSPITAL

The total duration of hospitalization for many acute cardiovascular problems has been decreasing, and safely too. The average hospital stay for acute ACHD illnesses varies. Common practices are:

Unstable Angina

Five to ten days if the patient "cools off" and is able to ambulate

without symptoms. If surgery is required, hospitalization will extend ten to twelve days post-operatively.

Acute Myocardial Infarction, Uncomplicated

Practice varies in different communities/institutions. The days given are ranges that may be encountered.

Subendocardial - Eight to fourteen days. This infarct involves the inner portion of the heart muscle.

Transmural - Ten to twenty one days. Damage through the full thickness of the heart muscle.

Acute Myocardial Infarction, Complicated

Hospitalization will be as long as is necessary to stablize the patient. Common complications include heart failure, confirmed pain difficult to control, and life-threatening arrhythmias.

Note: If cardiac arrest has occurred and the patient has stabilized, hospitalization need not be prolonged.

Coronary Artery Bypass Graft Surgery

Hospitalization is generally ten to twelve days.

GOALS OF IN-PATIENT REHABILITATION

Education

Patient and family teaching should be started early. The crisis situation should be capitalized on in an initial attempt to modify behavior. The counselor can and should participate in this process along with other members of the rehabilitation team. It has been observed that patients who are educated during the acute phase of an illness actually do not retain much of the factual information given them. This has led to a feeling in some that it is a waste of time to educate patients while hospitalized. On the other hand, most inquiries from a patient are really a reflection of anxiety and concern regarding the illness and the future. Careful, compassionate and consistent answers to these questions will go a long way toward allaying anxiety during the crisis period. A repeat comprehensive education program can, and should, be offered following discharge and should include both patient and spouse.

Psychosocial and Vocational Assessment/Intervention

Compassionate, understanding care plus appropriately aggressive, pragmatic problem-solving by the social worker, psychologist/psychiatrist and vocational rehabilitation counselor work to preserve psychosocial and vocational integrity.

Careful Mobilization

The goal of progressive ambulation in hospital is to take a patient from complete dependence on admission to the hospital to full independence as a totally comfortable convalescent by the time of discharge. All activities of daily living should be safely accomplished by discharge. Progressive activity programs have been developed at several centers for patients with acute myocardial infarction, unstable angina pectoris, and post-saphenous vein bypass surgery. The activities are the same for each illness; the rate of progression varies. Some programs emphasize exercises, others the activities of daily living, still others a combination of both.

An example of one progressive activity program follows. Others are available. All are designed to take a person from complete dependence on admission to functional independence by the time of discharge. A similar activity progression would hold for patients with unstable angina and after surgery, though the timing might vary somewhat.

ACUTE MYOCARDIAL INFARCTION
CARDIAC REHABILITATION PROGRESSIVE
ACTIVITY PROGRAM
UNIVERSITY OF COLORADO MEDICAL CENTER

Date of Event:

Type/location of event:

Acute Phase	1-4 days
Complete bed rest until pain remits	
1st to 4th day	1) Orientation to Rehab. program 2) Bedside commode 3) Feed self 4) Active foot exercises 5) Partial a.m. care (wash hands, face, brush teeth) 6) May sit in chair at bedside for bed making 7) May stand to be weighed 8) O.T. activity 9) Dangle for feeding; a.m. care 10) Sit in chair (15-30 min.) up to 3 times daily

Semiacute Phase 5-10 days	
5th and 6th day	1) Walk to bathroom 2) Up in chair 3-4 times daily as tolerated 3) Sponge bathe self (seated) 4) Walk in room 5) O.T. work simplification/activity
7th and 8th day	1) Continue up in chair as tolerated 2) Sponge bathe (standing) 4) Walk 50 feet 5) Walk in room ad lib 6) O.T. Clinic - wheelchair
9th and 10th day	1) Bathe in tub or shower (initially transported by WC) 2) Progressive ambulation on ward
Convalescent Phase 11-14 days	
11th to 14th day	1) Continue all other prior activities 2) Cont. walking in hall as tolerated 3) Stairs before discharge as needed

Progressive activity will be individualized according to patient's needs and conditions and should be increased as tolerated using signs and symptoms and heart rate guidelines: Maximum heart rate increase of 16-20 beats per minute over resting heart rate for any activity.

ABSOLUTE/RELATIVE CONTRAINDICATIONS: shock, CHF, ventricular arrhythmias, angina

Note:

1. All activities are Functional Class III or IV except for use of the commode and for climbing stairs.
2. There is nothing magic in these programs; they meet the goal of careful mobilization stated above and have proved safe over several years of use.
3. The patient's pulse is taken before and upon completion of any new activity and before following any therapeutic exercise

session in hospital. This is done by the person who initiates the new activity. This will provide a useful guide for permissable activity levels after discharge.

The progression of activity in hospital is performed in the company of and under the supervision of a nurse or therapist capable of monitoring the patient for untoward responses.

Acute Phase — The bedside commode is used instead of the bedpan - it requires much less energy (4 vs. 5 METS).

It takes less energy to sit in a chair than it does to roll around in bed while it is being made.

The patient participates in self-care from the beginning to avoid cultivating a sense of dependency.

Semiacute Phase — This phase programs a rapid return to full self-care (activities of daily living).

Leaving the ward to go to the O.T. or P.T. departments may provide a real "lift" for the cardiac patient and help him to put things in a more realistic perspective when he sees patients without limbs, others who have been severely burned, who are para or quadriplegic, or children with developmental problems, all working to improve a position that is often worse than his own. The natural post-MI depression may begin to lift after the first visit to the Physical Medicine & Rehabilitation Department.

Convalescent Phase — If stairs are required after the patient returns home, it is helpful to allay fears about this activity by demonstrating competence before leaving the hospital.

POST-HOSPITAL REHABILITATION

Rehabilitation must not end on release from hospital. The long-term effort designed to optimize the medical, psychosocial and vocational status of the client should begin soon after discharge and continue indefinitely. The goals of the outpatient effort are the same as for the general program:

Improve the Quality of Life
- Work
- Educate
- Preserve psychosocial integrity

Extend Life — Improve Its Quantity
- Risk factor identification and modification
- Optimize medical and surgical treatment

The client should be seen by the physician within two weeks of leaving the hospital — this allays frustration, anxiety, feelings of helplessness and helps to ensure an emotionally comfortable convalescence and an orderly return to work and responsibility. The comprehensive care approach to the patient/client must be continued throughout his follow-up. Each visit should include a careful history and physical examination, psychosocial and vocational assessment, and occasionally (often at two, six and ten weeks after discharge) an electrocardiogram and exercise evaluation (usually on the motor-driven treadmill). Additional follow-up ideally occurs at six months after the acute event, and then every six to twelve months indefinitely.

Physical reconditioning is often considered synonymous with outpatient rehabilitation and indeed forms the core of most long-term rehabilitation programs. However, other important activities must not be neglected: risk factor identification and modification, motivation for adherence to reconditioning activity, employment and maintenance of a stable psychosocial environment at home, at work and in the community. These topics are covered elsewhere in this handbook. In this section, the physical reconditioning program will be emphasized.

RECONDITIONING

The principles of writing a reconditioning prescription, as outlined here, apply to healthy persons as well as those with disease.

Although most cardiac clients can improve their level of condition-

ing, some are too ill to participate and others should not because of excessive risk or associated medical contraindications.

Excessive Risk of Reconditioning

1. Unstable angina.
2. Symptomatic arrhythmias.
3. Heart failure.
4. Diastolic hypertension — if there is persistent elevation (greater than 120 mmHg) with exercise. An exercise test will indicate the response of the diastolic pressure to exercise.
5. Significant valvular disease — especially if associated with a low, fixed cardiac output that cannot rise with exercise.
6. Faintness in the upright position at rest or with exercise. Lightheadedness, syncope, difficulty thinking, visual blurring, decreased vision with a change in body position or during exercise indicate inadequate brain oxygenation.

Unsuitable Reconditioning Candidates

1. Chronic alcoholics — if still drinking, they will neither adhere nor improve. The ex-alcoholic should respond well and should not be prevented from participating.
2. Other life-threatening disease: malignancy, near-terminal diabetes or renal disease, etc. Any condition nearing the end of its natural history is a relative contraindication to reconditioning.

The most common causes for rejection from a reconditioning program will be unstable, inadequately treated conditions, poor motivation, and another severe illness complicating management of the cardiac disease.

Motivation and Adherence

People join and remain with a reconditioning program for many reasons, some often quite individual and personal. However, some generalizations can be made regarding most important (primary) and less important (secondary, tertiary) reasons for motivation and adherence. The counselor can play an important supportive role in reinforcing the client's positive thoughts regarding reconditioning.

Motivation — Why should a client join a reconditioning program?

Primary — to feel better
— to be healthier
— to decrease the chance of another acute cardiac episode (usually a heart attack)

— to increase the level of comfortable and safe physical activity

Secondary — to gain knowledge about health
— to participate in recreation
— to experience pleasure
— to vary a dull routine

Tertiary — to socialize
— to please a supportive person

Adherence — why will a client remain with a reconditioning program? What are the important adherence factors?

Note that items considered relatively less important for joining become critically important for remaining in the program. In addition, a well-run program is critical to high adherence.

Primary — good program organization and leadership
— enjoyment of exercise
— enjoyment of recreation and games
— socialization with others

Secondary — the benefits of improved health and fitness
— a sense of accomplishment

In spite of all this, the KEY to adherence is the attitude of the spouse (usually the wife). If she is neutral or negative the likelihood of prolonged adherence is slim; if she is an enthusiastic supporter of the program, adherence will be 80 percent or better.

Important background determinants of adherence include a history of regular exercise or participation in sport, enjoyment rather than boredom from exercise, and a competitive personality.

Reconditioning Prescription

There are three elements to consider in writing the exercise prescription:

Intensity — how hard to exercise.

Frequency — how often to exercise.

Duration — how long each exercise session should last.

Many approaches to aerobic training are available, each with strong advocates. All methods will produce a training effect. Individual methods of training are beyond the scope of this handbook; however, generalizations that apply to all approaches can be made.

Intensity

How hard the subject exercises can be based on either heart rate or oxygen consumption. Heart rate is clearly the easiest to monitor — almost anyone can be taught to count a pulse reasonably well.

When an exercise evaluation is performed, the highest safe heart rate (clearance heart rate) is determined. In order to ensure the safety of exercise outside of the controlled environment of the stress test laboratory, a 15 percent margin of safety is provided, i.e. the highest effort permitted is 85 percent of the clearance heart rate. In most clients, this will permit a significant degree of improved conditioning.

A word of caution: if the subject or client is cleared for very high levels of exercise, but is not in good physical condition, exercise for the first several weeks should be at a considerably lower level than that for which clearance is provided. This will avoid severe muscle and joint problems which will hinder progress and adherence. Similar advice can be given for work; rather than begin at peak output initially, the client should work up to high levels gradually.

Frequency — To achieve a substantial conditioning effect, at least three exercise sessions a week on non-consecutive days are desirable. A higher level of conditioning and perhaps a greater likelihood of making exercise a habit can be obtained by exercising five or more times a week. Once a conditioning level has been achieved, it can be maintained by as few as two workouts each week. However, most well-conditioned individuals, normals as well as cardiacs, will *want* to exercise more than twice weekly. It takes less time and effort to maintain a level of conditioning than it does to attain it.

Duration — Each exercise session should probably be a minimum of 20 to 30 minutes. A typical session should be composed of:

Stretching and calisthenics — five to ten minutes of warm-up at less than target heart rate.

Aerobic exercise — 20 minutes.

Cool down — five to ten minutes.

Exercise Guidelines — An example of an exercise guideline handout for patients follows. The "acceptable sensations" and "warning symptoms" comments hold for work as well as reconditioning exercise.

UNIVERSITY OF COLORADO MEDICAL CENTER
Cardiac Rehabilitation Unit
EXERCISE GUIDELINES

Intensity: Walk (jog) ____ mile(s) in ____ minutes. Your average heart rate should be from ____ to ____. These numbers are 70% and 85% of your maximum safe or clearance heart rate of ____ determined by your treadmill evaluation.

Frequency: Exercise at least three to five times per week.

Duration: Maintain your exercise for 20-30 minutes at least.

Types of Exercise Recommended: Walking, jogging, bicycling, swimming. (Do not start until your doctor okays the exercise.) These are aerobic exercises — they help in your conditioning.

Avoid isometric or static exercise (exertion without movement)

NOTE:

To measure your heart rate count your pulse for ten seconds and multiply by six.

Don't exceed your highest target heart rate of ____.

Always "warm-up" three to five minutes. See warm-up exercises.

Allow for a "cooling down" period — while you take your pulse move your legs in a walking motion while standing in place. Then, walk slowly three to five minutes before stopping.

Do not exercises soon after eating — wait approximately 2 hours.

Avoid exercising out-of-doors when the weather is severe — too cold or too hot. An indoor shopping mall is a good place to walk when the weather is bad.

NO maximal efforts of any kind.

Acceptable Exercise Sensations Include:
moderate breathlessness
moderate fatigue
moderate sweating
a *pleasant* sense of muscular fatigue

Warning Symptoms: Stop if you note:
chest pain
excessive shortness of breath
fatigue, more than expected for a particular activity
dizziness, light-headedness
irregular heart beat
nausea

Effects of Conditioning — Regular endurance aerobic exercise has a significant impact on the client and his body. Some of the readily observed effects are:

1. Cardiovascular-pulmonary
   - decrease the heart rate and blood pressure at rest and exercise
   - increase exercise time required to achieve a maximal effort
   - improve the extraction of oxygen by the tissues
   - increase the volume of blood pumped with each heart beat
   - increase lung capacity and ventilation
   - increase the work load before angina pectoris occurs
2. Psychosocial
   - acts as a tranquilizer
   - improves work performance
   - increases work output
   - improves physical energy and stamina
   - improves ability to handle stress and tension
   - decreases food intake and sleep requirements

In addition, these and some other factors may be of potential benefit in modifying the natural history of ACHD. Although habitual exercise has not been incontrovertibly proved to affect the course of ACHD, the evidence that it is of real benefit is strongly suggestive. If exercise truly works in modifying the natural history of ACHD, it would represent great benefit for little expenditure of either time or

money. At the time of this writing, it would appear that for those in whom there is no contraindication, regular endurance aerobic exercise should be prescribed.

Although at the present time it appears that exercise may be good therapy for selected patients with ACHD, it has not been shown that:

- exercise makes atherosclerotic placques go away;
- exercise prevents the formation of placques;
- exercise extends life.

However, because of the potential benefits of regular aerobic exercise that may affect both quantity and quality of life, and the intellectually unsatisfactory alternative of doing nothing in an effort to modify natural history, a reconditioning program using the guidelines given above seems rational and prudent.

RETURN TO WORK

At almost any time during the outpatient rehabilitation program, the client may inquire about or request permission to return to work or to seek employment. It is important to always reinforce a desire to work, even though it may be premature to actually begin work again. With a few modifying provisions, the decision to return to work can be made using guidelines outlined for writing the intensity portion of the reconditioning prescription.

For example, first have the client take an exercise stress test. Determine clearance heart rate. Take 85 percent of clearance heart rate (again, build in a 15 percent margin of safety) and see at what MET level this heart rate occurred. This is the highest energy cost the client should have to experience on the job. Look up the average energy cost of the job the client is considering (Table 8, pages 82-84) or visit the job site to estimate the energy cost; if this does not exceed the MET level at 85 percent of clearance heart rate, the client could probably return to work with reasonable comfort. As the counselor considers the decision regarding return to work, the factors which may modify the transfer of stress test results to the work situation should be remembered. These factors include client personality, activity environment, emotional impact of the work situation and amount of isometric stress involved. A careful review of these items, together with the information obtained from the exercise evaluation should yield return to work advice that is safe for the client and which optimizes early employment. In addition, this approach to return to work counseling should allay the fears some counslors have about returning the

client to an enviroment the client may not tolerate well and which may therefore result in additional disability, another acute episode or even death.

ENERGY COST OF ACTIVITIES

	MET RANGE
SITTING: LIGHT TASKS	**1.5-4.5**

Desk work, typing
Driving cars, trucks
Using hand tools, light assembly
Crane operation
Working levers
Playing cards, seated games
Machine sewing
Flying
Painting, recreational
Horseback riding, walk and trot
Golf cart, riding
Fishing from boat, seated
Riding mower

STANDING: MODERATE TASKS **2.5-5.5**

Standing quietly, working at own pace - light assembly or hand tools
Scrubbing, waxing, polishing
Assembly or repair of machine parts
Light welding, woodworking, interior carpentry
Power sanding
Stocking shelves
Light-medium assembly line work
Crank dollies, hitching trailers, operating large levers, jacks
Wiring house
Bricklaying, plastering, house painting, paperhanging
Hoeing, raking, weeding
Clean windows

WALKING: LIGHT-MODERATE TASKS **2.5-5.5**

Gas station attendant
Carrying trays, dishes, etc.
Walk to 4 mph on level
Billiards, bowling
Fishing - bait casting and fly with waders
Shuffleboard
Volleyball, non-competitive
Archery
Sail small boat
Dancing
Gardening
Golf
Tennis, doubles
Calisthenics
Making beds
Mowing lawn - cast or power unit
Table tennis

STANDING AND/OR WALKING: HEAVY TASKS

Pushing or moving heavy objects — 75 lbs or more, e.g. moving van work	8.0
Cutting wood	
Power saw	2-4
Hand axe or saw	5-10
Digging, shoveling	4-8
Wheelbarrow	4-10
Plumbing	3-8
Snow shoveling	6-15
Lifting and carrying-	
20-44 lbs.	4.5
45-64 lbs.	6.0
65-84 lbs.	7.5
85-100 lbs.	8.5
Pneumatic tool work	6.0
Skate - roller, ice	5-6
Badminton, competitive	5-7
Tennis, singles	6-9
Paddle ball, raquetball, squash, handball	7-15
Skiing	

Downhill	5-8
Cross-country	6-12
Water	5-7
Hunting	
Small game	3-7
Big game	3-14
Swimming	4-8
Jogging, running	7-15
Basketball	5-12

Table 8. Approximate energy cost of some common vocational and recreational activities. The client with an aggressive personality will tend to use more energy than a non-aggressive client.

The decision about when the client can return to work will principally be made by the client's physician using information from the medical history, physical examination, stress evaluation, and information provided by the counselor regarding the work environment and specific job tasks. Information requested on the VR Cardiac Referral Form (p. 47-48) is necessary in order to write a safe activity prescription for work, play or reconditioning.

The following sections on management will outline some of the treatment methods that are not the responsibility of the counselor. However, an understanding of these procedures and medications is important if the counselor is to have a full understanding of the client and his problems. Indeed, the side effects of drugs may be a major source of disability and may affect the clients vocational viability. Occasionally, a necessary drug may require modification of jobs tasks, e.g. ground level work for a client on antihypertensives (which may cause too low a blood pressure with light-headedness, poor balance, instability, visual changes, fainting and near fainting). Fortunately, however, the medications a client takes usually decrease the symptoms of disability, permitting improved work tolerance and productivity. If medications are well adjusted, limiting side effects should be relatively rare.

The sections dealing with psychosocial and vocational management will have direct pertinence to the counselor. They are not intended to be a repetition of standard practices found in vocational counseling texts, but are designed to speak to the specific problems associated with cardiac disease.

MEDICAL MANAGEMENT

The most common cardiovascular conditions that can be successfully managed medically are hypertension, pump failure, cardiac pain and arrhythmias. Symptoms associated with these conditions have been discussed in earlier sections of this handbook and will not be reviewed here. Each condition will be discussed independently. Several drugs will appear in the management of more than one clinical situation. A discussion of these drugs will be given only the first time it appears. These tables are necessarily brief. Additional information can be found in reference volumes such as the *Physician's Desk Reference* or *The Merck Manual*.

SURGICAL MANAGEMENT

The surgical management of cardiac disorders has taken enormous strides in recent years. The development of the heart-lung bypass machine, materials and effective designs for artificial valves, and new surgical procedures and techniques have helped thousands of clients return to productive lives. Cardiac surgery is expensive but is often, if not usually, followed by a gratifying outcome. If necessary, an operation may be repeated although the procedure is usually technically more difficult the second or third time around. The more common cardiac surgery procedures will be reviewed briefly.

CORONARY ARTERY BYPASS

Effective techniques for improving or reestablishing a blood supply to an area of ischemic heart muscle were sought for many years. In 1968 the first coronary artery bypass operation was reported. Since then, the procedure has received universal acceptance and increasing numbers of patients are benefitting from its use.

Indications

The primary indication for coronary bypass is angina pectoris that cannot be adequately controlled by medical therapy. An additional major indication is severe disease of the left main coronary artery or its equivalent (high-grade obstruction in the upper portion of both the left anterior descending and circumflex coronary arteries). Other indications accepted by some include myocardial infarction that is extending in size (a very high risk situation), unstable life-threatening ventricular arrhythmias (surgery may not be effective), and unstable angina pectoris.

CARDIAC PAIN

ANGINA PECTORIS:

DRUG	COMMON NAMES	ACTION	COMMON SIDE EFFECTS
Nitrates, short-acting Nitroglycerin	TNG Nitroglycerin Nitrostat	Decreases work of heart & 0_2 demand by decreasing heart work, dilates coronary arteries	Increased heart rate — palpitations. Flushing. Headache — transient — lasts 15-20 minutes.
Nitrates, long-acting	ISDN, Isordil, Sorbitrate, Cardilate Nitro-bid	Decreases work of heart & 0_2 demand by decreasing heart work, dilates coronary arteries	Increased heart rate — palpitations. Flushing. Headache — transient — lasts 1-6 hours.
Propranolol	Inderal	Decreases 0_2 demand of heart by decreasing heart rate & force of contraction	Fatigueability, weakness, intestinal upset, rash, vivid dreams, hair loss, NB-may worsen heart failure and should not be used in asthmatics

MYOCARDIAL INFARCTION: usually requires narcotics for relief. 93

HYPERTENSION

DRUG	COMMON NAMES		ACTION	COMMON SIDE EFFECTS
Diuretics ("water pills")	hydrochlorothiozide Diuril Hydrodiuril Esidrix Naturetin	Renese Hygroton Lasix Aldactone Dyrenium	Decrease body water content and blood pressure	Weakness, intestinal disturbance, skin rash, headache
Vasodilator	Apresoline		Dilates small arteries	Headache, rapid heart action, fever, intestinal upset, flushing
Sympathetic nervous system inhibitors	Reserpine		Interfere with nerve impulses that cause blood vessel walls to contract	Drowsiness, sedation nasal congestion, depression, muscle aches
	Ansolysen			Faintness on standing, dry mouth, blurged vision, impotence
	Ismelin (guanethidine)			Faintness on standing, dry mouth, fever, nasal congestion, depression
	Inderal			See cardiac pain section

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PUMP FAILURE

DRUG	COMMON NAMES	ACTION	COMMON SIDE EFFECTS
Digitalis	Lanoxin, digoxin Digitoxin	Increase force of contraction	Nausea & vomiting, disturbances of heart rhythm, yellow tinted & blurred vision, weakness, arrhythmias
Diuretics	See hypertension section	Decrease body fluid	See hypertension section
Nitrates	See cardiac pain section	Decrease resistance to blood flow	See cardiac pain section

Additional medical management techniques for pump failure often include rest, salt restriction, modification of an emotionally stressful situation or environment and oxygen in more severe situations.

ARRHYTHMIAS

DRUG	COMMON NAMES	ACTION	COMMON SIDE EFFECTS
Quinidine sulfate	Quinidine, Quinidex Quinaglute, Cardioquin	Decreases the tendency to premature beats inhibiting the action of abnormal areas of heart beat formation	Nausea, vomiting, dizziness, respiratory distress. Occasionally fainting spells. Skin rash, headache, fever, confusion
Procainamide	Pronestyl		Joint discomfort, arthritis, skin rash, pleurisy, anemia
Propranolol	Inderal		See cardiac pain section
Digitalis	See pump failure section		See pump failure section
Diphenylhydantoin	Dilantin		Slurred speech, staggering gait, confusion, intestinal upset, rash, overgrowth of gums

The Procedure

All candidates for coronary bypass surgery must have a heart catheterization with selective coronary arteriography in order to identify the location of the coronary artery obstructions so that the sites of the bypass graft attachments can be determined. At surgery, veins are removed from the leg (saphenous vein), sewn into the base of the aorta and a coronary artery beyond the obstruction(s) identified at cardiac catheterization. During the time of sewing the grafts to the aorta and coronary arteries, the patient is placed on the heart-lung machine (cardiopulmonary bypass) so that the operative field can be kept dry and quiet. The time of cardiopulmonary bypass is 45 minutes to two hours.

Results

Relief of angina has been reported in 85 to 95+ percent of patients. The natural history of patients with left main coronary disease is improved. The natural history of coronary disease other than left main disease may be improved (especially for unstable angina), but the data are not clear at this time. On the average, 75-85 percent of grafts remain open one year after surgery.

Comments

Clients sometimes feel that once they have had bypass surgery, the disease is cured. This, of course, is not true. Coronary artery bypass surgery is best viewed as a technical event in the natural history of a dynamic disease process. The operation does not make the disease that is present go away, nor does it prevent new obstructive disease from forming. Therefore, the comprehensive approach to cardiac rehabilitation, including risk factor identification and modification, psychosocial and vocational intervention, education, etc. is just as important for the post-bypass patient as for other patients with ACHD.

VALVE REPLACEMENT

Chronic rheumatic valvular disease causes scarring of the heart valves producing obstruction to blood flow (stenosis) or incompetence of the valve (insufficiency). If either process is severe enough, the heart's ability to withstand the load placed upon it by the damaged valve may be compromised and significant disability may occur mainly as a result of pump failure. With the development of cardiopulmonary bypass and effective materials for making artificial heart valves, many patients afflicted with chronic valvular heart disease have been returned to functional personal and vocational lives.

Indications

Heart valve replacement is indicated when significant cardiac disability results from the stenosis or insufficiency of the valve and when other forms of surgical and medical treatment either cannot be used or have become ineffective.

The Procedure

The patient is placed on the cardiopulmonary bypass machine, the chest opened, the diseased valve carefully removed and a prosthetic valve sewn into the fibrous valve ring that supported the patient's own valve.

Results

Current prosthetic valve technology is such that, in most instances, valve abnormalities can be, for the most part, corrected. Occasionally, a leak of varying size and significance may be present at the valve ring. Most prosthetic valves have some degree of obstruction inherent in their design, but this is not sufficient to cause problems and places much less of a load on the heart than the valve it replaced.

At the present time, valves generally are not subject to clots forming on the struts and materials are of sufficient strength so that cracking or rupture is exceedingly unlikely. The valves can remain in place indefinitely. This was not the case with early prosthetic valves and many patients have had to undergo reoperation.

The degree of improvement the client can expect is largely related to the ability of the heart to recover from the long-term volume or pressure load placed upon it by the diseased valve(s). If there has been little fibrosis or scarring in the myocardium of the affected chamber(s), the hypertrophied muscle fibers can return to normal, heart size will diminish and normal cardiac function and oulook will be reestablished. On the other hand, if considerable fibrosis has taken place the heart may not be able to return to either normal size or function and residual disability, usually from pump failure and arrhythmias, remains.

Comment

Patients who have had heart valves replaced are often required to take anticoagulant medication in order to prevent blood clots from forming on the valves. These medications cause the blood to take longer to clot, an item of potential importance if the client has a job in which the risk of cuts or injury is high.

VALVULAR SURGERY WITHOUT VALVE REPLACEMENT

Some valve defects, both congenital and acquired, may be surgically improved without having to resort to valve replacement. The most common procedure of this type is mitral commissurotomy for mitral stenosis due to chronic rheumatic valvular disease. The commissurotomy (cutting or breaking of the scar tissue which binds the junction of the valve leaflets — the commissures) may be performed under direct vision (open) or by feel (closed). Usually, considerable improvement can be made in the valve opening and substantial functional improvement realized. Risk of the operation is very low. It is not uncommon for the scar tissue to reform and for stenosis of the valve to become reestablished after a number of years so that reoperation is necessary. Fortunately, the procedure can usually be repeated one or more times with good results.

Other procedures include:

Mitral Anuloplasty — Taking a tuck in the mitral valve to reduce the amount of mitral insufficiency.

Valvuloplasty — Surgical reconstruction of a deformed valve (usually mitral or aortic) entailing the removal of scar tissue and calcium deposits. This procedure is performed to improve or correct stenosis or insufficiency of the valve.

PACEMAKERS

Heart block rhythms with a very slow heart rate and low cardiac output cause symptoms of low cardiac output, exercise intolerance, fainting and other neurologic complaints. The medical management of these conditions was occasionally effective, but not nearly so valuable, safe or reliable as electronic pacemakers. These devices may be used in life-threatening emergency situations associated with slow heart rates, but their greatest application is in long-term pacing. Current models may remain in place without need to replace the power source for three to five years. The major types of pacemakers are demand and fixed rate. The fixed rate pacemaker will pace the heart at a pre-set rate (usually 70-75 beats/minute) regardless of the heart's underlying intrinsic rhythm. The demand pacemaker has a sensing device that monitors the heart's intrinsic beating pattern and permits the pacemaker to operate only when the heart is not beating adequately (i.e. on demand). A recent pacemaker development has been the atrial synchronized unit which senses atrial activity, then

vauses the ventricles to beat shortly after. This has the advantage of producing greater pump efficiency (atrial beat followed by ventricular) and of permitting the ventricular heart rate to increase according to normal body responses which adjust heart rate to body requirements. Finally, atomic powered pacing units have become commercially available. Atomic units are expensive but claim a very long pacing life and thus do not require replacement of batteries as often as other units.

The Procedure

Commonly, the pacing stimulus is delivered to the heart through a catheter. An electrode on the tip of the catheter is wedged in the inner wall of the right ventricle. The catheter is passed from a subclavian vein, either right or left, through the superior vena cava, right atrium, across the tricuspid valve and is wedged in the apex of the right ventricle. The power source is placed in a pouch just under the skin in the upper chest area, Figure 5. The procedure usually takes less than an hour and can be done under local anesthesia.

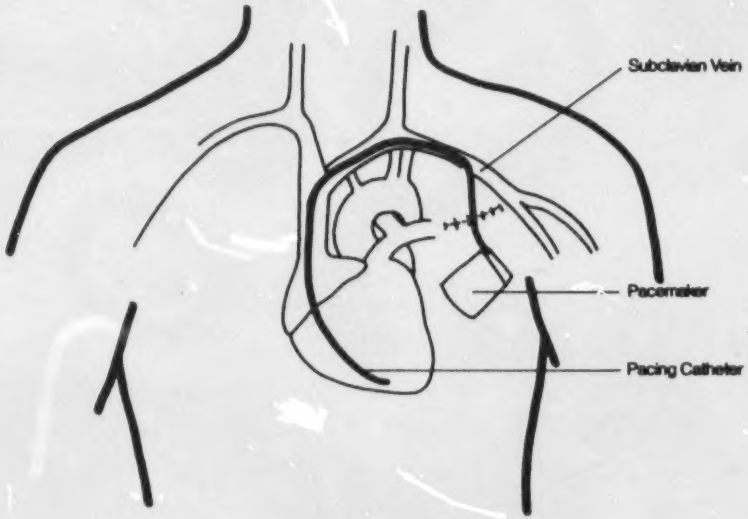

Figure 5. Location of pacemaker and pacing catheter. The right side of the chest may also be used as the site for the power source. Modified from Netter.

Comment

Pacemaker implantation is the least traumatic of any cardiac surgical procedure. Hospitalization need not last longer than three to five days and discomfort from the surgery is modest and short-lived. No special medications are required after surgery. The client's usual medications, and others as indicated, may be given without affecting pacemaker function. If the power source fails, it may be replaced without changing the pacemaker catheter. Complications of pacemaker implantation are uncommon but may include infection, perforation of the heart by the pacing catheter (rarely fatal), failure to control the heart beat, and arrhythmias resulting from myocardial irritation by the catheter.

Patients with pacemakers should probably avoid close contact with equipment capable of producing an electrical hazard. These devices, which generate rapid electrical signals, may cause the pacemaker units to pace abnormally. Fortunately, most pacemaker manufacturers have included "noise circuits" in their units which will put the pacing generator in a fixed rate mode when subjected to rapid electrical discharges. Sources of energy which may affect pacemaker function include microwave ovens, diathermy, electric razors, strong magnetic fields and radar pulses at physiologic rates. The counselor and client should consult with the attending physician to obtain a list of hazards known to affect the pacing generator being used. This information is helpful in ensuring a safe working environment for the pacemaker client.

RESECTION OF VENTRICULAR ANEURYSM

Occasionally, the scar of a large infarcted area stretches, becomes thin, and balloons outward from the left ventricular wall (ventricular aneurysm). This aneurysm is associated with an increased likelihood of pump failure, arrhythmias, and blood clots. If these complications become difficult to manage medically, removal of the aneurysm may improve pumping efficiency and eliminate the complication.

SURGERY FOR CONGENITAL HEART DISEASE

As with other forms of cardiac surgery, procedures to palliate or correct congenital heart defects have made great strides since development and improvement of the cardiopulmonary bypass machine. Children who would otherwise have succumbed to their

illness can often be operated on while very small, total correction achieved and time bought until a definitive procedure can be performed. At the present time, many patients with congenital heart disease have been rendered normal and others have been improved to the point of becoming functioning members of the community, both socially and vocationally. The scope of congenital heart defects, the technical aspects of their correction and psychosocial and physiologic factors which may affect post-operative outcomes are complex. Individual defects will not be considered here. In general, acyanotic defects can often be successfully repaired whereas cyanotic congenital problems are oxten more complex, require more tehnically difficult procedures and have more complicated post-operative courses.

PSYCHOSOCIAL MANAGEMENT

Intervention in the psychosocial problems resulting from the interaction of personality and behavior with changes resulting from the stresses of acute and chronic illness demands involvement of all members of the cardiac rehabilitation team including the VR counselor. Each time the patient/client is seen by a member of the team, attention must be given to the psychologic aspects of the illness. Not all patients/clients will require extensive questioning or counseling, but comprehensive care demands longitudinal, open-ended consideration of at least some of the following factors that can affect psychosocial adjustment:

1. Emotional responses — usually fear, anxiety, depression, denial.
2. Personality or behavior pattern — try to modify the Type A client.
3. Roles assumed by patient and spouse during and after convalescence — is temporary role reversal causing problems?
4. Amount of denial — is the overall response characterized by failure to accept the facts of the illness and, if so, to what extent?
5. Problems with returning to work — difficulty finding work, difficulty adjusting to it, necessary job modifications, employer ignorance, peer worker overprotectiveness or other inappropriate reactions.
6. Needs for reinforcement of teaching relating to ACHD. This should include the spouse as well as the patient.
7. Financial situation.

In general terms, the patient's emotional response and rehabilitation potential can be classified as follows:

Aggressive — Denial, unwilling to make appropriate behavior and life style changes. Rehabilitation is quick and long-term outcome uncertain.

Constructive — Adapts and changes. Good rehabilitation potential.

Regressive — Unable to adjust. Rehabilitation difficult/impossible.

Fortunately, most patients work through emotional responses and respond to the event or illness constructively. The comprehensive care approach for the patient with cardiac disease, or any chronic illness for that matter, is the best method of ensuring a constructive response. Prevention should be a first approach in management; a good program of patient and family education as well as early assessment and intervention in problems can be quite effective in preventing psychosocial problems.

The major reactions which are most appropriately handled via psychological intervention are discussed here more or less in chronological order of their appearance.

ACUTE RECOVERY PERIOD

During the earliest stages of illness, of course, the emergency care of the patient is paramount. Crisis intervention may be necessary in the acute illness in the case of the CCU delerium syndrome, but the treatment, and to a great extent prevention, of this reaction should have become routinely incorporated into the operation of the CCU. This stress reaction is a simple matter to prevent in most instances, and once it occurs it is easily treated by the CCU personnel. Dealing with the family's reactions of alarm and distress at the delerium reaction, however, is a matter of careful education and explanation of the causes of the delerium and its transient nature. The manner in which the acute crisis is handled by the patient and his family, with the support and intervention of the staff, will be the focal point in many instances for the progress of the patient's recovery and rehabilitation in the days and weeks ahead. Social casework is a frequent necessity during this period to assist the family in financial and economic stress, and dependent upon circumstances, may be required for some time and for more permanent solutions, such as the spouse's employment.

The severely depressed patient has the least favorable chance of

surviving the acute coronary event. Psychotherapeutic intervention and psychotropic drugs, whenever possible, are the most apparently successful combination of treatments for these depressive reactions. The ease and success with which the family adapts is probably influential on the course and persistence of depressive reactions.

The prognosis for the patient with adequate but not exaggerated denial mechanisms is much superior. At least during the acute and early recovery periods, the patient is well served by these coping strategies and no attempts should be made to interfere with them. This period of "useful" denial may last several weeks. Obviously, there are instances of extreme denial which can be self-destructive and should be firmly and promptly discouraged by direct confrontation. Confrontation should be undertaken advisedly, however, since if denial is removed and not replaced by other coping mechanisms, the patient is left open to depression.

RECOVERY AND REHABILITATION PLANNING

The rehabilitation counselor's role and strategies of intervention at this stage are most important. Early contact, inquiry and counseling centering around the client's full environment, stress, activity requirements and return to the former job, with or without modifications, are the usual approaches. If the client was not working at the time of the acute episode, the reason must be determined and a cooperative plan made if the client will be capable of returning to work.

Hopefully, the patient will be involved in a physical reconditioning program and is receiving frequent instruction and counseling from other members of the cardiac rehabilitation team concerning activities, nutrition, and modifying heart disease risk factors such as smoking habits, weight reduction, etc. Psychological risk factors may also require intervention, though no specific personality or emotional patterns aside from depressive reactions can be positively equated with recurrence of myocardial infarction. Many modifications of the patient's behavior with respect to his job, recreational activities, and family relationships are self-imposd and inappropriate, thus creating unnecessary stresses. As an example, many patients greatly curtail or even abstain from sexual intercourse because of the occurrence of symptoms such as angina, from fear of recurrence of MI or of causing sudden death. Most patients can return to intercourse comfortably

and safely by six weeks after an acute illness such as heart attack. Effective counseling and education should prevent most misguided client-initiated behavior.

Patients may also unreasonably delay resuming recreational or vocational activities, an unfortunate situation since the longer the delay, the less favorable the prognosis for their eventual resumption. Counteracting or preventing this delay in returning to activity is largely a function of early, direct education. There are, however, instances in which psychological intervention may also be required to deal with more serious and persistent fears and anxieties which delay a return to activity. In addition, there is the problem of secondary gains which may occasionally arise in the cardiac patient who would like to preserve his dependent status, remain exempted from unwelcome demands, or has received other gains which he may be unwilling to relinquish (this is the regressive response). Obviously such problems as these are complicated, requiring long-term attention and are not readily resolved through brief crisis intervention strategies. Often, however, to be completely realistic, the prognosis for significantly modifying these motives is not good.

Patient compliance with or adherence to the rehabilitation program including the physical reconditioning routine is quite certain to reach a plateau fairly soon after the resumption of nearly normal activities. Often after the crises have passed and typical activity patterns are resumed, the motivation for keeping out-patient appointments, following the exercise prescription and the like begins to wane. The client may disregard his diet and begin smoking once again. The motivating forces of fear and anxiety may have disappeared and been all but forgotten within a few months of the acute coronary episode. This is a serious problem, and since much of the cardiac rehabilitation team's impact on the patient has been lost by this time, the usual intervention strategies are not significantly effective in reversing this trend once it occurs. Consistent, long-term follow-up is difficult to arrange and to maintain, but it is probably the best approach to prevention of recurrent problems, maintaining a risk factor modification program, and possibly the recurrence of myocardial infarction. Rehabilitation counselors, who may have contact at intervals for some time with the ACHD patient, should be alert and assertive about the patient's motivation for maintaining the gains which have been made during the time of most intensive contact with the client. Occasionally, the

rehabilitation counselor may need not only to inquire about the patient's compliance and adherence to the rehabilitation program, but should also seek the opinions and attitudes of the other family members. Perhaps the counselor will need to insist that the patient make and keep appointments for follow-up examinations and education. Even though the damaged cardiac muscle has healed, the rehabilitation counselor, as well as the client, must not lose sight of the fact that ACHD is a chronic disease and exacerbations do occur, and quite likely will if the disease risk factors are totally ignored.

As a potentially significant community resource for the maintenance of gains made by the patients and their families, a self-help movement for the former coronary patient has begun in many metropolitan areas in recent years. These self-help groups are sometimes called "Mended Hearts" in the case of cardiac surgery patients, and may be a valuable resource to which clients can be referred. State and local chapters of the American Heart Association also provide patient counseling, referral services, and other consultation in some instances which may prove to be of benefit in vocational rehabilitation.

VOCATIONAL MANAGEMENT

Follow-up studies of cardiac patients indicate that 70-90 percent of people who have had a heart attack are able to return to work. About three-fourths of these can return to the work they did prior to the attack. One-third of clients who return to their old job will require some modification of job tasks in order to remain in the previous vocation. Time from the heart attack until the client returns to work should not usually exceed three months, especially if the client and the rehabilitation team members are vocationally oriented and transmit positive feelings about returning to work. The likelihood of the client returning to work decreases after six months and is virtually nil if the client does not work within one year of the attack. If the client was not working at the time of the attack, it is unlikely that any effort will result in employment after recovery is complete.

Since most patients with acute cardiac problems will return to work whether there is planned rehabilitation or not, one might wonder who the candidates for vocational intervention really are. Actually, a visit by the counselor during hospitalization for the acute event can be useful for all patients. The visit should include a basic vocational history, transmit a feeling of strong vocational commitment on the part

of the rehabilitation team, and may surface potential job stresses that can be prophylactically managed. For many clients, one visit may be all that is necessary or indicated. Other clients will become active in the system once it is learned that a specific job cannot be tolerated — these clients will require the more intensive management outlined in the paragraphs which follow.

The counselor should not be discouraged about work outcome in clients with residual cardiac symptoms. It has been shown that cardiac functional capacity, symptoms of congestive heart failure and persistent angina pectoris, while potentially limiting the intensity of tasks that may be performed, are not impediments to employment and are usually not related to whether a client returns to work or not.

VOCATIONAL PLANNING

Most cardiac patients can be helped to establish an appropriate pattern of living and work by the services provided under a suitable vocational rehabilitation program.

The rehabilitation process is ideally based upon a close working relationship between physicians, nurses, social workers, vocational rehabilitation counselors, psychologists and others. The validity of vocational planning is highly dependent upon the exchange of information and support services that can be provided by each discipline.

Vocational planning includes information about the client's medical, social, psychological and vocational assets and disabilities. Evaluation of *all* areas must be completed in order for vocational planning to be valid.

An understanding of the client's aptitudes, skills and work habits developed from past employment, vocational interests and motives is essential.

Family relations are similarly important. The structure of the family and the relationship between family members can often determine the amount of time and effort a rehabilitation program can take. Of course, the financial resources of the patient must always be considered in vocational planning.

Rehabilitation is most likely to succeed when intervention occurs early in the course of the illness. Unfortunately, relatively few individuals with heart disease are provided early vocational rehabilitation services. Referral, if it occurs at all, comes only after an extended period of time.

Appropriate and timely access to vocational rehabilitation services can occur only if there are well established communication and working relationships between state rehabilitation agencies and

— community hospitals and physicians
— cardiac rehabilitation programs, personnel and facilities
— voluntary health and consumer groups
— major medical centers and health care facilities.

A VR counselor assigned to an acute care facility and known to the medical staff is in the optimal position to provide effective early intervention for the cardiac client.

SPECIAL JOB CONSIDERATIONS

Job Development

Job development should be initiated before the client is ready for employment.

Short-range as well as long-range vocational goals often must be developed in order to facilitate vocational rehabilitation of the cardiac client. These goals must be the product of the efforts of both client and counselor and must be acceptable to the client.

It is usually possible and desirable to return the cardiac client to his former job. The situation is familiar to the client, modifications are easier to make, and the employer may be willing to make necessary work load adjustments if the employee is unable to resume full responsibilities.

A change of occupations requires that the client be able to learn new skills. This process may be quite time-consuming and employment after completion of the training may be uncertain. Often, the client must compete with younger individuals for the job. In addition, earnings may be lower than the client's needs and expectations, a potential source of major concern.

The employer should always be fully informed as to the progress of rehabilitation and the activity limits of the client. These limits cannot be left to the judgment of employers, but are determined by careful evaluation and discussion by the physician and counselor. It is most important that the patient-employee and his supervisor fully understand any temporary or permanent functional limitations. The limitations are determined by data obtained from thorough exercise testing and job analysis. The use of the VR Referral Form, p. 47-48, is helpful in establishing the limits imposed on work activities.

Job Analysis and Modifications

No two jobs are exactly alike and no two clients will respond in the same way to similar work situations. The counselor must assess skill requirements, work environment and effort required on each job. In addition, variations in production quotas, speed of operation and deadlines must be considered since these demands may cause stress, anxiety, frustration and tension — concerns which may substantially affect job counseling decisions. An on-site job analysis should document the extent to which these elements exist. This information should be given to the medical consultant, industrial physician, management and private physician, and job modification needs discussed and implemented.

Most workers perform job tasks at considerably less than maximal physical capability so that even if some functional capacity is lost, most cardiac clients can still perform pre-attack job tasks safely and well. The counselor can anticipate that up to 90 percent of clients employed at the time of a heart attack will be able to return to work, most to the pre-attack job. Of those who return to the same job, about one-third will require some modification of job tasks. Most clients who are union members will want every effort made to retain them in the pre-attack position since a change in job may be associated with a loss of seniority.

A coordinated effort to assess and determine appropriate job modifications may involve the counselor, private physician, industrial physician, client, foreman, and occupational therapist. This effort is indicated when it appears that a client may not function optimally on return to work, when performance on the job is sub-par and prior to a cardiac beginning a new job. The cost of job modification is almost always less than retraining an employee.

It is always helpful and sometimes important for the counselor to visit the job site to observe specific tasks required, the physical organization of the work site, attitudes of supervisors and other employees and the response of the client to the demands of the job. Time spent on such site visits is invaluable to both the client and counselor.

FAVORABLE HIRING FACTORS

Employers are well aware of the cost involved in retraining employees. An employer must consider the costs of maintaining the employment of an employee who suffers a cardiac problem against

the retraining costs of a new employee. Basically, employers are interested in maximum useful productivity without increased costs. In addition, employers are concerned that the cardiac worker must remain in a single position, thus reducing manpower flexibility and efficiency — an important concern for the business with few employees.

Some favorable employment factors include:

— industries with a low proportion of male employees in heavy labor
— wholesale or retail trades
— management, clerical or sales occupations
— no formal age or health policies for hiring
— a history of experience with the disabled in general
— a practice of retraining employees who develop cardiac disease.

Other potentially favorable factors for employment include:

— an Affirmative Action Plan for Handicapped by federal contractors
— an abundance of jobs available (a low rate of unemployment) in the community.

UNFAVORABLE HIRING FACTORS

Unfavorable hiring practice often relates to employer lack of understanding of the individual who has suffered a cardiac problem. A lack of understanding of the ability of the cardiac patient to return to work can cost the employer reduced production by attempts to retrain workers instead of making temporary adjustments until the employee returns to work. The opportunity for the counselor to educate employers is obvious. In this regard, the counselor becomes a real advocate for the client.

Until full employment is achieved, if it ever can be, minorities, older people, disabled, unskilled, and the less educated will comprise a great percentage of the unemployed.

Even among younger, uncomplicated myocardial infarction patients, ten to twenty percent do not go back to work — most because of physician's advice against work or for personal, psychological or social reasons.

Employers often view hiring or re-employment of cardiac patients as involving extra costs which raise their overhead. These costs may include:

— extra costs for special physical examinations
— decrease of employee flexibility and versatility
— higher costs associated with paid company sick leave
— higher costs of employee benefits, such as health, disability, major medical insurance
— higher rates of absenteeism
— possibility of workmen's compensation claims.

Several studies comparing cardiac employees to controls doing the same jobs in the same companies have shown that cardiac employees lost more work days and had more days lost per incident. These unfavorable data may not hold for the client who has been part of a comprehensive rehabilitation program: these clients generally do well, have little absenteeism, and produce well. These same studies found no workmen's compensation claims by cardiac employees.

Seniority rules and practices may become obstacles to re-employment and vary with companies, industries, and labor unions. The employee's attitude concerning a reassignment or job modification must also be thoroughly reviewed and assessed.

EMPLOYERS

Employers should be contacted by the counselor early in the recovery phase of the client's illness. Information about the recovery and the possibilities of modification of work should be discussed prior to the client being ready to return to work. Assistance is needed and frequently requested by the employer to evaluate the job and develop the work situation in which the patient can function effectively.

Important questions to be answered from the employer's viewpoint are:

— Will employment aggravate the person's cardiac disease? Generally, no.
— Can the employee safely do the job? Almost always.
— Will he be able to work up to normal capacity? Two-thirds of those that return to the pre-attack job will be able to work to pre-event capacity.
— How will other employees and supervisors react? They will react well if management takes the proper lead and they are included regarding details of disability and job modification requirements, if any.

— Will the employee be dependable? The usual non-medical considerations of dependability apply: barring an unstable medical situation, a dependable worker before an attack will be a dependable worker afterwards.

The VR counselor can and should be an active advocate on behalf of the client. Dealings with employers permit the optimum expression of this important counselor role. Using the knowledge the counselor has regarding heart disease, causes of disability, etc., the counselor can put the information to work to modify employer attitudes and policies. Furthermore, the counselor should make it clear that he/she will be happy to assist in any future problems encountered between the client and employer. The ultimate payoff of this active advocacy by the counselor will be to create more jobs for the disabled and to maintain a maximum duration of employment.

FOLLOW-UP

It is essential to utilize all appropriate resources once the patient has returned to work to periodically evaluate adjustment to the physical and emotional stresses associated with resumption of employment. Not all employment problems may be identified or anticipated prior to the client's returning to work. Problems which surface after employment may be complex and may tax the counselor's resourcefulness. As with counseling activities before employment, it is important for the counselor, members of the rehabilitation team and employer to maintain contact so that pertinent information can be exchanged and incorporated into the rehabilitation plan. Continuous participation of the counselor after employment, together with other members of the cardiac rehabilitation team, will assist in the integration of all elements of the work adjustment process.

It may be necessary for the vocational rehabilitation counselor to assist or lead in the coordination between the patient's physician, the industrial or company physician, and others in facilitating the selective placement and follow-up process.

Vocational rehabilitation, as with other elements of the rehabilitation program, should be considered an open-ended process requiring intermittent evaluation and follow-up.

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GLOSSARY

AEROBIC - Literally, requiring oxygen. A form of exercise characterized primarily by the use of oxygen as the source of energy. Common examples include walking, jogging, endurance running, cycling. The only form of exercise for which there is any evidence of a portective effect against coronary atherosclerotic heart disease.

ANEURYSM - A bulging of the wall of a vessel (either artery or vein)or heart chamber (usually the left ventricle).

ANGINA PECTORIS - A feeling of pressure, weight, tightness in the chest due to inadequate oxygenation of a portion of heart muscle. May radiate to the arm(s), neck, through to the back and may be associated with weakness, nausea, vomiting, sweating, shortness of breath. Relieved by rest, nitroglycerin. A common source of disability in clients with coronary artery disease.

ANGINA PECTORIS, STABLE - Angina that is predictable in its frequency, severity, precipitants and relief.

ANGINA PECTORIS, UNSTABLE - Angina that is unpredictable: comes with less effort, is more severe than in recent past, requires more nitroglycerin for relief, may occur at rest.

ARRHYTHMIA - A change in the heart's rhythm from the usual, normal mechanism. Some arrhythmias are benign and are not associated with heart disease. Others are clearly abnormal and are a source of significant disability.

ARTERIAL BLOOD - Oxygenated blood pumped by the left ventricle to all parts of the body.

ARTERIOSCLEROSIS - A commonly used term for hardening of the arteries.

ARTERY - A vessel which carries blood pumped from one of the ventricles: right ventricle - pulmonary arteries to the lung; left venticle - systemic arteries with muscular walls carrying oxygenated blood to all organs of the body.

ASCITES - Free fluid in the abdominal cavity. In clients with heart disease, is usually due to right ventricular failure. However, the most common cause of ascites is liver disease.

ATHEROSCLEROSIS - The process of hardening of arteries (sclerosis) due to fat deposits (atheromata) in their walls.

ATHEROSCLEROTIC CORONARY HEART DISEASE - Heart disease caused by atherosclerotic deposits in the coronary arteries.

ATRIUM - One of the two upper chambers of the heart. Receives blood from the veins (right atrium - unoxygenated blood from the systemic veins; left atrium - oxygenated blood from the pulmonary veins) and ejects blood into a ventricle.

BLOOD PRESSURE, DIASTOLIC - The lower blood pressure reading. Measured in millimeters of mercury (mmHg). Normal - usually 70-85 mmHg; borderline hypertensive - 85-100 mmHg; hypertensive - consistently greater than 100 mmHg.

BLOOD PRESSURE, SYSTOLIC - The upper blood pressure reading. Increases modestly with age. Usually 110-140 mmHg. Considered hypertensive if consistently over 160 mmHg.

BRADYCARDIA - Slow heart rate, usually less than 60/min.

CALORIE - A unit of food energy. One calorie, or kilo-calorie is the amount of heat required to raise the temperature of 1 gram of water 1 degree centigrade. Also used to quantitate work loads; i.e. the number of Calories required to accomplish a certain task.

CAPILLARY - Small vessels which form a network between the arteries and veins. The walls of capillaries are one cell thick, permitting the passage of oxygen and nutrients out of the blood and into the tissues and carbon dioxide and other metabolic waste products from the tissues to the blood.

CARDIAC OUTPUT - The amount of blood that the heart pumps in a minute, measured in liters. Normal range is 4-6 L/min.

CHOLESTEROL - A lipid (fat) substance found in many tissues of the body. When elevated in the blood, it increases the risk of developing coronary artery disease. Blood cholesterol is derived from what is eaten and what the body makes.

CIRCULATION, PULMONARY - The flow of blood through the lungs: from right ventricle → pulmonary artery → pulmonary capillary bed → pulmonary veins → left atrium.

CIRCULATION, SYSTEMIC - The flow of blood through the body, except for the lungs: from left ventricle → aorta → major systemic arteries → arterioles → capillaries → veins → right atrium.

CLAUDICATION - Cramping discomfort with exertion in the muscles of a limb caused by an inadequate arterial (oxygenated) blood supply.

CONGESTIVE HEART FAILURE - Inability of the heart to adequately pump the blood brought to it by the veins. When this happens blood backs up in veins bringing blood to the heart and congestion of various organs may occur, especially the lungs and liver.

CORONARY ARTERY - One of the arteries that supplies the heart muscle with freshly oxygenated blood. The major coronary arteries are the right coronary and left main coronary artery which divides into the left anterior descending and circumflex coronary arteries. The coronary arteries arise from the base of the aorta and lie on the surface of the heart.

COR PULMONALE - Heart disease caused by disease of the lungs or blood vessels in the lungs.

CYANOSIS - A blue tint to the skin due to inadequate oxygen being carried by the blood. Most easily seen in the nail beds and tissues covering the mouth and tongue.

DIASTOLE - The relaxation phase of the heart chambers.

DIGITALIS - A medication which improves the strength of the heart's contraction and increases its pumping efficiency when it is failing (see congestive heart failure). Digitalis is also used to treat some abnormalities of heart rhythm. Symptoms of excessive intake of digitalis are quite common in clients taking the drug (nausea, vomiting, poor appetite, yellow or brown tint to vision).

DIURETICS - A group of medications which stimulate the formation of urine and therefore the elimination of fluid from the body. Diuretics are most commonly used in heart failure and high blood pressure.

DYSPNEA - Shortness of breath; labored or difficult breathing. A prominent symptom in heart failure.

EDEMA - Swelling due to an excessive amount of fluid in the tissues of the body.

EDEMA, PULMONARY - Fluid in the breathing spaces of the lung resulting from heart failure. Often an acute, life-threatening illness.

ELECTROCARDIOGRAM (ECG, EKG) - A graphic recording of the electrical activity of the heart. Useful in assisting with the diagnosis of arrhythmias, myocardial ischemia, injury or infarction, electrolyte and metabolic problems.

EMBOLUS - Material, usually a blood clot, carried in the blood stream

until it impacts in a smaller vessel, limiting or occluding the circulation.

ENDOCARDITIS - Inflammation, usually a bacterial infection, of the inner lining of the heart (endocardium), usually the heart valves. Residual disability results from damage to the heart valves.

FIBRILLATION - Uncoordinated, fine, rapid contractions of the heart chambers. Arterial fibrillation is usually well tolerated with appropriate medication; ventricular fibrillation is the major cause of sudden death.

HDL - HIGH DENSITY LIPOPROTEINS - One group of fat and protein molecules (the lipoprotein) that correlates inversely with the risk of developing coronary artery disease, i.e. the higher the HDL, the lower the risk. HDL is higher in women and may be increased by regular aerobic exercise.

HEART ATTACK - Common language for myocardial infarction: death or damage of heart muscle due to inadequate blood flow to an area of the heart.

HEART BLOCK - An abnormality of heart rhythm in which impulses from the atria are partially or completely blocked from reaching the ventricles. Severe forms have very low heart rates (25-40/min), often cause fainting spells and are treated by electronic pacemaker insertion.

HEART FAILURE - See Congestive Heart Failure.

HEART RATE, CLEARANCE - The highest heart rate that is safe for activity. At this rate, there are no symptoms and the blood pressure and heart activity (as monitored by the exercise electrocardiogram) are normal.

HEART RATE, TARGET - The highest heart rate the client should achieve during activity: work, play or exercise. Commonly taken as 85% of the clearance heart rate. Target heart rate (THR) = Clearance heart rate (CHR) x 0.85.

HYPERTENSION - High blood pressure. Persistent elevation of blood pressure is a risk factor for the development of coronary artery disease and may cause enlargement of the heart, kidney damage, and heart failure. Normal pressure in adults is 120-140/70-90.

HYPERTENSION, DIASTOLIC - Persistent elevation of the lower (diastolic) blood pressure reading.

HYPERTENSION, LABILE - Blood pressure that at times is abnor-

mally elevated; at times normal. Although not as serious as persistently elevated blood pressure, labile hypertension is associated with an increased risk of coronary artery disease.

HYPERTENSION, PULMONARY - High blood pressure in the lung circulation. Seen in severe pulmonary disease, some forms of rheumatic heart disease and congenital heart disease.

HYPERTENSION, SYSTEMIC - High blood pressure in the arteries of the general (as opposed to pulmonary) circulation.

HYPERTENSION, SYSTOLIC - Persistent elevation of the upper (systolic) blood pressure reading.

HYPOTENSION - Abnormally low blood pressure. Usually refers to a serious situation such as shock and not to asymptomatic low blood pressure.

INDERAL, PROPRANOLOL - A medication used to treat chest pain (angina pectoris), some abnormalities of heart rhythm and systemic hypertension. Blocks many effects of adrenalin and similar substances.

INFARCT - Death of tissue due to inadequate oxygen supply.

ISCHEMIA - A deficiency of blood to a part of the body or organ; usually temporary and caused by obstruction to flow of blood in an artery supplying the organ or part. Ischemia of heart muscle is usually caused by coronary artery disease and is characteristically manifested by angina pectoris.

ISOMETRIC - Static exercise in which there is muscular contraction but no resulting motion. Characterized primarily by a marked rise in blood pressure.

LDL - LOW DENSITY LIPROPROTEIN - A fat-protein complex which carries the majority of the cholesterol in the blood. High cholesterol in this lipoprotein fraction is generally considered predictive of future coronary artery disease.

LIPOPROTEIN - A complex of protein and fat.

MET - METABOLIC EQUIVALENT - A unit for estimating the energy cost of aerobic activities. One MET is approximately 3.5 cc of oxygen consumed each minute for each kilogram (2.2 lbs) of body weight. Almost all activities of daily living can be performed at 4 METS or less.

MYOCARDIAL INFARCTION - (Coronary occlusion) - Commonly called heart attack: death or damage of heart muscle due to an inadequate blood supply.

NITRATES - A group of medications used in the management of chest pain due to myocardial ischemia. May be taken by dissolving under the tongue, chewing, swallowing, or application to the skin.

NITROGLYCERIN - The most commonly used and rapid acting of several nitrate compounds which, when dissolved under the tongue, relieves the pain/discomfort of angina pectoris. Nitroglycerin is a short acting (onset in 30 sec-2 min; duration 15-20 min) nitrate which is carried by most clients with coronary disease. It deteriorates in heat and light, a fresh supply must be purchased periodically, and unused portions should be stored in the refrigerator to maximize the duration of its effectiveness.

ORTHOPNEA - The inability to lie flat because of shortness of breath. Usually an indication of left ventricular failure.

OXYGEN CONSUMPTION - The amount of oxygen (0_2) required by the body to do aerobic tasks. Usually expressed in cubic centimeters (cc) of oxygen utilized per kilogram of body weight (kg) each minute (cc/kg/min). See MET; aerobic.

PALPITATION - Awareness of the heart beat. Usually described as an unusually forceful beat, irregular heart action, and often as a "flip-flop" or pause followed by a strong beat (usually caused by a ventricular premature contraction).

PAROXYSMAL NOCTURNAL DYSPNEA (PND) - Awakening suddenly in the night because of acute shortness of breath. An indication of left ventricular failure. The shortness of breath (dyspnea) usually lasts a short time (15-30 minutes) and then the client is able to sleep comfortably again.

PERICARDIUM - The fibrous sac in which the heart lies.

REHABILITATION - The process of returning the patient/client to the *optimal* physiologic, psychologic, social and vocational status and then maintaining that position.

REPOLARIZATION - The position of the electrocardiogram which represents the recovery of the ventricles following a heart beat. Represented by the ST segment and T wave. These changes represent inadequate blood supply, often reversible, to a portion of the heart muscle.

RISK FACTOR - One of several items (factors) which, if present in an individual, indicate an increased risk of developing coronary artery disease. The most common risk factors identified to date

include: family history of coronary disease, hypertension, smoking, high blood cholesterol, Type A personality, physical inactivity, obesity, diabetes, age, diet, stress and being male.

SATURATED FAT - A fat which can not accept any more hydrogen atoms. Usually solid at room temperature. A diet high in saturated fat (whole milk, whole milk products, fatty meats) is commonly associated with a rise in blood cholesterol and an increased risk of developing coronary artery disease.

STENOSIS - A narrowing of an opening. Usually applied to heart valves, especially the mitral and aortic valves. Stenosis of a heart valve functions as an obstruction to flow of blood across the valve.

STRESS TEST, EVALUATION - A procedure which places the cardiovascular system under stress, usually a form of exercise. Almost all stress evaluations (a better word than test, which implies that one can fail the procedure) are performed using the treadmill and bicycle ergometer.

SUDDEN DEATH - Generally considered to be death within one hour of the onset of symptoms.

SYNCOPE - Fainting. Many possible causes are known, some of which implicate the heart as the problem.

SYSTOLE - Contraction of one of the heart chambers. With systole, blood is ejected from the chamber into an artery (ventricular systole) or another chamber (arterial systole).

TACHYCARDIA - Rapid heart action. Generally considered to include heart rates greater than 100/min.

THROMBOPHLEBITIS - Inflammation and blood clotting in a vein.

THROMBUS - A blood clot. May form in a blood vessel or in one of the heart chambers.

TRIGLYCERIDE - One of the blood lipids which may have a role in the development of coronary artery disease. Not a primary risk factor as is blood cholesterol. Increased by a diet high in sugar (refined carbohydrates).

VEIN - A vessel which carried blood back to the heart. All veins carry blood whose oxygen has been removed by the tissues (unoxygenated) except the pulmonary veins which conduct freshly oxygenated blood from the lungs to the heart.

VENOUS BLOOD - Blood contained in the veins. Except for the pulmonary veins, venous blood is unoxygenated, brought to the

right side of the heart where it is pumped to the lungs and oxygenated.

VENTRICLE - One of the two lower chambers of the heart. Pumps blood into arteries: left ventricle - aorta and systemic arteries; right ventricle - pulmonary artery and pulmonary circulation.

VLDL - VERY LOW DENSITY LIPOPROTEIN - One of the fat-protein complexes in the blood. The major transport system for triglyceride.